LECTURE 3

3.1 Land Clearing

Land clearing is the removal of native vegetation for agricultural purposes and other developmental projects. When clearing land, particularly for agricultural purposes, the density of native cover and soil type must be considered to help conserve the topsoil.

This is an operation usually carried out before the conventional tillage in a farm land. Generally, there are several operations that are involved in land clearing depending on the type of vegetation, soil condition, topography, the extent of clearing required and the purpose for which the clearing is done. The land clearing operations include the following listed below;

1. Removal of all vegetation at the ground level and moving and stacking them in windrows for burning so that roots are left to decay or to be removed at later dates.
2. Removal of all tree and stumps include roots, and moving and stacking them in windrows for subsequent burning.
3. Ploughing and mixing in the vegetation to a soil depth of about 20cm and allowing it to decay.
4. Knocking all vegetation down and crushing it to the surface of the ground to be either burnt or left to decay.
5. Killing or retarding the growth of small trees by cutting the roots below surface of the ground and leaving them to decay or removing and stacking them for subsequent burning if necessary.

Mechanized agriculture requires a proper land clearing completion that will avert premature failure of the conventional tillage machines put in use subsequently and minimize soil nutrient depletion and structural damage due to interacting heavy land clearing equipment-bulldozer and so on. To avert these adverse effects, it is usually advisable that land clearing should be better done in the dry season when the soil has adequate mechanical stability or impendence to resist soil deformation or structural damage. This is at minimal soil moisture content; the risk of soil structural damage is minimized with the corresponding high shear strength which can withstand both the vertical and horizontal loads of the tractor – implement aggregate.

Total removal of vegetation is required for land clearing done for highway, dam construction and as well as building site for poultry. In these particular requirements, the need to preserve the top soil (that houses the essential nutrient) and avert the soil structural damage is inconsequential unlike in mechanized agriculture. The following factors among others, affect the rate of clearing;

1. Rainfall
2. Topography
3. Equipment used
4. Skill of equipment operators
5. The end use of the land being cleared
6. Sizes and kinds of trees
7. Density of vegetation
8. Soil condition

The aforementioned factors listed above determine the various capacities of equipment used for land clearing for farm operations.

Bush clearing for crop production referred to as agricultural bush clearing is different from bush clearing for other purposes. This is because, whereas the cardinal objective in clearing for other purposes is not only the removal of all bush, rubbish, debris and other objectionable materials, the top soil is also removed and may be replaced with sub soil (lateriting) and where necessary compacted or stabilized depending on the type of project. In agricultural bush clearing, the top soil must be preserved. The top soil contains nutrients needed by crops for optimum performance Agricultural bush clearing is therefore defined as the process of scientific removal and disposal of existing material, vegetation, rubbish and other obstructions from the land by manual, mechanical and chemical means for agricultural food production.

Agricultural bush clearing operation is effective only when all the unwanted vegetation including all roots and stumps are removed with minimum disturbance to the top soil. This is done to a maximum depth of 20 cm.

3.2 Objectives of Land Clearing

The basic objectives of agricultural bush clearing and land development are to remove unwanted materials from the land and to increase the size of land to be cultivated. Unwanted materials include trees, boulders, stumps and tree trunks. These materials cause obstructions to smooth operations of the tractor during subsequent tillage and other operations on the land. Tall trees also prevent rain and sunlight from getting to the soil by shielding. The area to be cultivated could be limited by presence of unwanted vegetation and undulating terrain, and stumps which could be easier removed using mechanical means.

Bush clearing in general increases erosion and sedimentation of waterways and reduces water quality. Also, the operation removes habitats leading to the direct loss of millions of native animals and plants. To reduce the negative effects of agricultural bush clearing especially in the tropics the

operation requires. Soils in the tropics are known to be delicate and low in organic matter content both down the depth and in profiling. In Nigeria for instance, about 63% of the soils are low in productivity and over 90 of them are alfisols and ultisols which are low in inorganic matter and have low activity clays.

3.3 Techniques of Agricultural Land Clearing

Land clearing operation can be accomplished through the use of one or more of these methods:

1. Hand method. (2) Burning. (3) Chemical method. (4) Explosive blasting. (5) Mechanical methods.

3.3.1 Hand Method

This method involves use of hand tools such as cutlass, hoes, axes, diggers for land clearing. However, when vegetation is thick, it is very tedious and costly. This method does not encourage mass production in agricultural production because of drudgery involved. It is also very difficult to work in the field cleared by this method because of the presence of stumps and underfoot which forms impediment to agricultural machines.

3.3.2 Burning Method

Burning method of land clearing is very common in the savanna belt of Nigeria for a variety of reasons: it clears the land for cultivation and for travel; it provides grazing at the time of the year when the grass is at its scariest; it drives game from cover thus facilitating their capture; man, appears to enjoy the sight of a good blaze especially at night. However, preliminary results indicate that this method adversely affects the soil in that the earthworm and microbial populations decrease as do the organic matter and nitrogen content and general fertility.

3.3.3 Chemical Method

Stumps and regrowth can be eliminated or killed by the use of arboricides. These are artificially prepared chemicals which kill unwanted forest trees. The arboricides that contain sodium arsenite are highly poisonous and should be handled with care.

3.3.4 Explosive Blasting Method

This method is employed to remove very big stumps to avoid excessive excavation of the soil. A wood auger is used to make a hold in the centre of the big stump and an appropriate quantity of dynamite is applied and remotely detonated to shatter the wood. In cases of smaller stumps, the soil auger may be used to bore hole in the soil and apply the explosive under the stump. This again shatters and removes the stump upon detonation.

3.3.5 Mechanical Method

Mechanical method is employed usually when a large area of land is required because of the cost. In this method of land clearing, various mechanical equipment are used, some of which are listed in Table 1. Some of the procedures for mechanical land clearing are: surveying, knockdown of trees, windrowing, burning and removal of debris, and pioneer ploughing. Survey helps to determine the size of tractor, the type and size of matched equipment, and the clearing method to be used. Two main operations are involved in mechanical land clearing: knockdown and windrowing, and removal of debris. The knockdown is the process of pulling or pushing down of the trees. Various mechanical tools are employed for the process which are: bulldozer blade, the rolling chopper, the anchor chain, and the winching cable.

3.4 Vegetational Zones of Nigeria

The vegetation of a place in Nigeria is determined by various factors such as the length of the rainy season, the total precipitation, as well as the temperature of the area. Thus, Nigeria has two major vegetation divisions: -

1. Forests to the South, 2. Savannas to the North

But it is often difficult to delimit where a forest becomes savanna. The vegetation zones of Nigeria are shown in Fig. 1. Within the general definition of forest, various types have developed in response to different environmental factors. At about 1200 m, temperature and other climatic factors account for the presence of montane forest which due to the scarcity of high ground, is very

rare in Nigeria. Where the soil is waterlogged for at least a part of the year, swamp forest may occur due to edaphic factor of high soil moisture. There are two types of swamp forest: brackish-water or mangrove swamp forest which extends along much of Nigerian coast especially where

there are well-developed tidal lagoons and rivers; and Fresh-water swamp forest which occurs inland from much of the mangrove forest and in the coastal reaches of the larger rivers. This type of swamp is in abundant in the delta of the River Niger.

3.4.1 Swamp Forests

These areas permanently occupy the brackish and tidal waters which are clad mainly with mangrove vegetation. Raphia palms are common and other forest trees.

3.4.2 Fresh water Swamp Forests

Fresh water swamp forests occupy the annually flooded areas of the river-bank areas and creeks. The soil is blue-black mangrove clay and alluvial usually swampy and unsuitable for agriculture, but mangrove trees provide pit-props, fuel, and tannin.

3.4.3 Rain Forest

Rain forests consist of big trees, and provide the bulk of the exploitable timber. The chief centres are Benin, Ondo, and Calabar. Lands of the rainforests are the farming areas of the South, producing root-crops for food, and cocoa, palm-oil produce, and kola nuts.

3.4.4 The Savannas

In the widest sense, the savanna zone includes the grass plains interspersed with trees. There are different

Types of savanna

3.4.4.1 The Guinea Savanna

Nearest to the high forest is the Guinea Savanna. It has limited visibility, an outcome of closely packed grass with trees. The annual firing of lands changes the dry season scenery to that of scorched, scattered, leafless stems standing on ash coated fallow lands.

3.4.4.2 The Sudan Savanna

It has shorter grass and medium-sized trees, usually acacias, dum and fan-palms, and shear butter trees. The loose sandy soils which characterize the zone in Sokoto, Katsina, and Kano provinces are farmed for groundnuts and millets, while the loamy soil of Zaria is ideal for guinea corn and millet. Cows have good areas for grazing also.

3.4.4.3 The Sahel Savanna

Farther North has poorer grass, fewer and more drought-resistant woody plants. This vegetation should be distinguished from the almost treeless grass in the more clayey and impervious parts of Bornu.

Table 1: Mechanical land clearing methods and equipment for different vegetation zones in Nigeria

Vegetation Zone	**Clearing Method**	**Power Unit (Crawler Tractor)**	**Equipment:**		**Remarks**
			Knockdown	**Raking**	
Mangrove	Single tractor knockdown	90 KW or more depending on tree diameter	Bulldozer blade Tree pusher, Clearing	Rake	Rake Lighter power units will aid transportation and traction
Tropical Rain Forest	Single tractor knockdown	200 KW and above	Bulldozer blade Tree pusher, Shearing Blade	Rake, shearing blade	Tractor armed with shearing blade will aid in cutting where necessary
Deciduous Forest (Derived Savanna)	Single tractor Knockdown	134 KW or less depending on tree diameter	Bulldozer blade Tree pusher, Clearing Rake	Rake, shearing blade	In developing secondary forest, chaining can be possible and is economical

					when the area is large.
Guinea Savanna	1. Single tractor knockdown 2. Chain knockdown	Above 90 KW Two Crawler tractors of 134 KW or more	Bulldozer, Tree pusher, Clearing Rake 5 cm link dia anchor chain 92 m or longer	Rake, shearing blade	For areas of 40 ha or less For large area with average tree diameter less than 45 cm, tree population less than 2,500/ha
Sudan Savanna	1. Single tractor knockdown 2. Chain knockdown 3. Chopping or root ploughing	About 65 KW 2 crawler tractors of about 134 KW 65 KW or less	Bulldozer, tree pusher 5 cm link dia anchor chain 92 m or more Rolling chopper	Rake, shearing blade Root rake	Average tree diameter slightly above 10 cm.
Sahel Savanna	1. Chopping and disking or root ploughing 2. Disking or	65 KW or less	Rolling chopper Rolling	Root rake Root	Average tree diameter does not exceed 7.5 cm – 10 cm

	root ploughing	65 KW or less	chopper	rake	

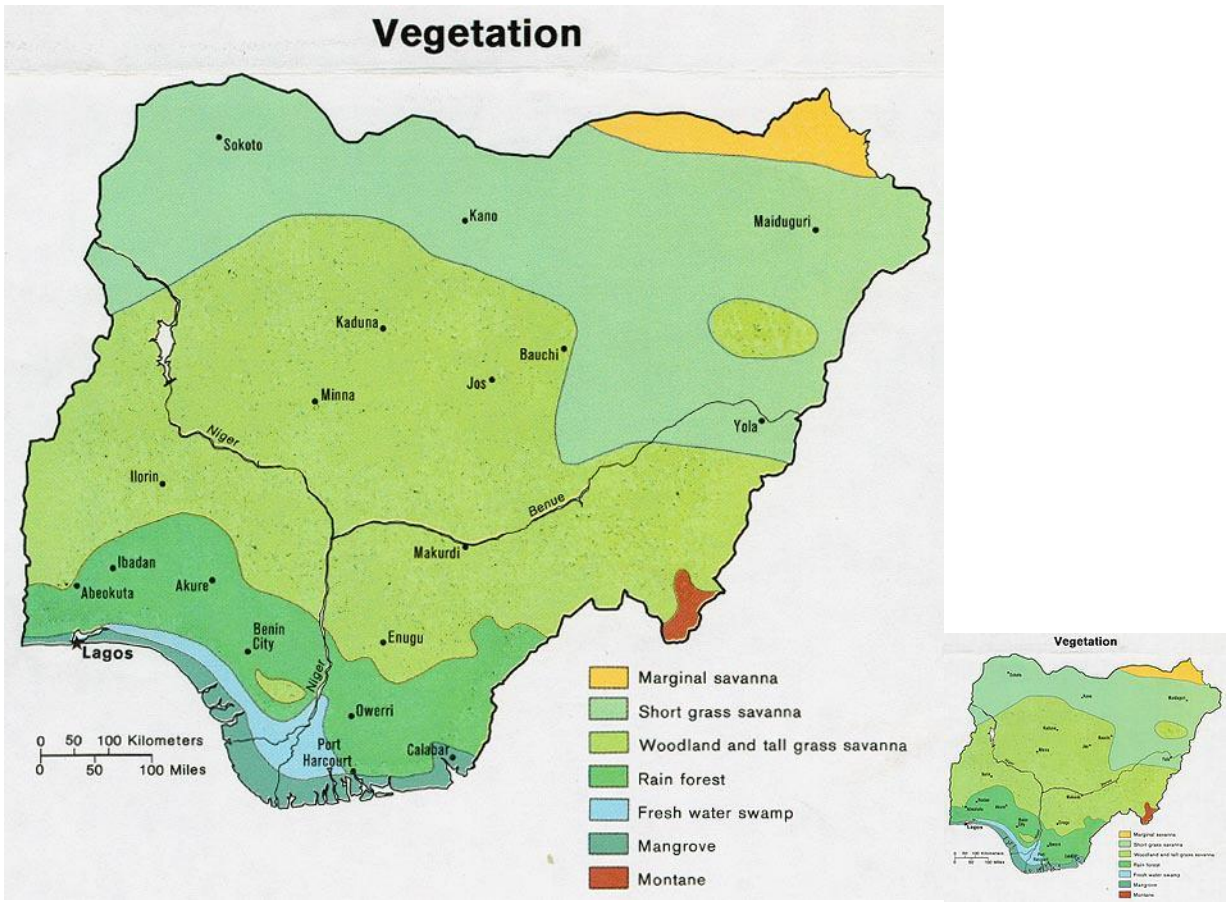

Fig 1: Vegetational Zones of Nigeria