Chapter 2

Predominant farming systems of the tropics

There is a wide range of farming systems in the tropics. They can be grouped into three principal categories – tree-based, animal-based and crop-based (Figure 7). The main farming systems are briefly described below.

TRADITIONAL FARMING SYSTEMS

Traditional farming systems have not changed much since the early 20th century. Shifting cultivation and bush fallow rotation are widely used in the tropics (Okigbo, 1978). These subsistence systems are diverse and based on low inputs. Several crops are grown simultaneously on the same piece of land. In some regions, especially on marginal or steep lands in densely populated regions, traditional "slash and burn" farming has been destructive and has caused severe soil and environmental degradation. In most of the lowland tropics with sparser population and relatively fertile soils, however, traditional systems have proved to be ecologically stable despite the minimal inputs of the shifting cultivators (Greenland, 1975).

The degree of severity of soil erosion and water runoff under traditional farming systems depends on the soil, land-use intensity, relief and cultural practices adopted. Runoff and erosion are generally reduced if the fallow period is long enough to restore soil physical properties and increase the soil organic matter content.

Traditionally, farmers abandon the land when crop yields are too low either because of prevalence of pests or because of deterioration in soil quality. The rate of decline in crop yield on soils under traditional farming depends on many factors – soil properties, crops grown, prevalent climate and soil management practices. A study by Allan (1965) in East Africa indicates that, on soils of high inherent fertility, it took 20 years of continuous cultivation to cause severe yield decline. On soils of low inherent fertility, however, yield declined under traditional farming in 1 to 2 years. There are urgent reasons to improve productivity even on soils where yield decline does not occur rapidly. The system is ecologically stable and works as long as the farmers are willing to remain at the subsistence level.

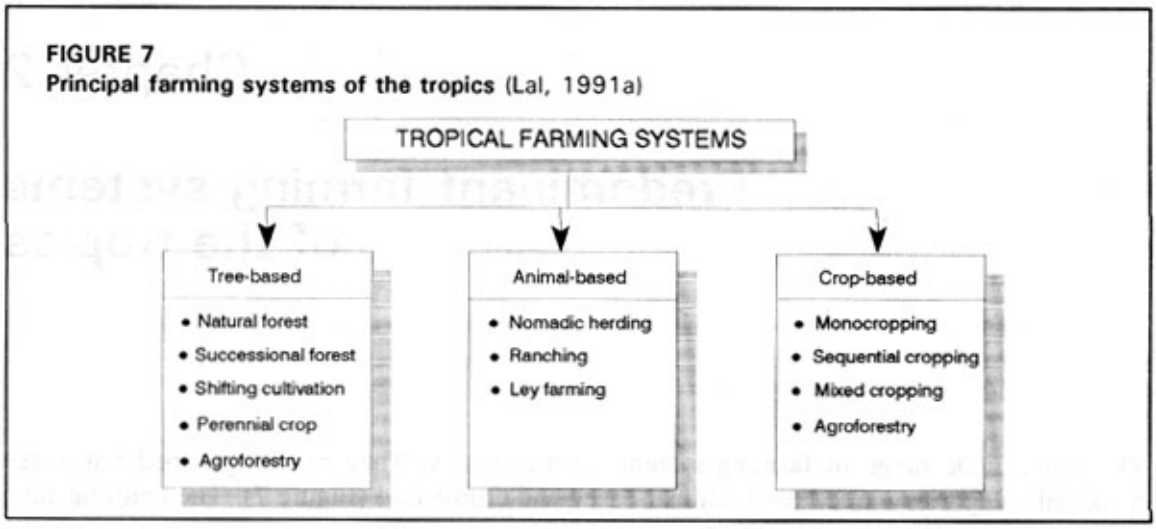

FIGURE 7
Principal farming systems of the tropics (Lal, 1991a)

SOME ALTERNATIVE FARMING SYSTEMS

Cropping and farming systems that have been tried as alternatives to shifting cultivation and bush-fallow rotations include the following:

Large-scale mechanized farming

Mechanized farming has been tried widely in Africa, but with limited success. Major physical obstacles to intensive cropping of crops such as maize, cowpea and groundnut by motorized farm operations in tropical Africa are severe soil compaction, accelerated erosion and low soil fertility. In attempts to grow a second crop, farmers often try to speed up the harvesting procedure. Mechanized harvesting is particularly damaging if the soil is wet.

Ranching and pasture development

Ranching is a popular system in the humid tropics. More intensive pasture development is successful only when the initial soil fertility is high and the stocking rate is carefully controlled, otherwise severe economic and environmental problems arise. Excessive and uncontrolled grazing can cause at least as many problems of soil and environmental degradation as mechanized farming. Excessive grazing depletes the vegetation cover, changes the species composition, exposes soil to high-intensity rains, compacts the surface soil layer and decreases the infiltration rate of the surface soil layer.

Forestry

Tree-based farming systems are very common in the humid tropics. It is generally believed that forest plantations and tree crops can provide ecologically stable systems. The belief in the restorative effects of forestry may be an overgeneralization because, with careless management, severe soil compaction and accelerated soil erosion and land degradation occur. Plantations make heavy demands for plant nutrients on the soil but, with good management,

the chances of attaining ecologically compatible systems are better with trees than other crops. Tree crops protect the soil against raindrop impact and insolation by their continuous cover.

Tree crops are key components of some agricultural production systems. These include:

- Fruit and nut orchards, plantations yielding oil, rubber, gums, tannins and drugs.
- Forest plantations providing timber and related forest products.
- Trees and shrubs maintained in natural or planted fallows to recycle nutrients for use by subsequent arable crops.
- Trees grown in association with food crops on farms and as plantation crops associated with animal husbandry.
- The Taungya system, or agrisilviculture, in which food crops are associated with forest trees for the first 2 to 3 years.
- Forest trees as components of integrated land development plans.