The multi-profits of agroforestry farming

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Agroforestry is a farming system that integrates crops and/or livestock with trees and shrubs. The resulting biological interactions provide multiple benefits, including diversified income sources, increased biological production, better water quality, and improved habitat for both humans and wildlife. Agroforestry is designed to accommodate the mature size of the trees while leaving room for the planned alley crops. When sun-loving plants like maize will be alley-cropped, the alleyways need to be wide enough to let in plenty of light even when the trees have matured.

Alternatively, the cropping sequence can be planned to change as the trees growth decreases the available light. For example, sunflower or maize could be grown when the trees are very small; then, as the tree canopy closes, forages could be harvested for hay; finally, when the trees are fully grown and the ground is more shaded, grazing livestock or shade-tolerant crops like mushrooms or ornamental ferns could occupy the alleyways.

Like all integrated systems, alley-cropping requires skillful management and careful planning. Both the crop and the trees have requirements that sometimes necessitate trade-offs between them. If either crop requires chemical herbicides or insecticides, the other must be tolerant of these treatments. In the case of livestock, there may be periods during trees and the livestock must be managed for production, some systems emphasize one over the other. Usually, in the early years of establishment, crops or hay are harvested from the planting. Grazing generally begins after two or three years, when the trees are large enough that the livestock can not damage them. In other instances, fencing may be used to protect the young trees, and grazing begins immediately. Grazing livestock on silvo-pasture eliminates some of the costs of tree maintenance. With good grazing management, for example, herbicides and mowing may become unnecessary. Grazing also enhances nutrient cycling and reduces commercial fertilizer costs; the animals remove few nutrients, and their waste is a valuable input for the trees. Well-managed grazing will increase organic matter and improve soil conditions. However, controlling the number of animals per acre, limiting the number of days those animals remain on each site, and avoiding compaction are critical for a successful silvo-pasture system.

Competition for water between the pasture and the trees may be a concern. In a silvo-pasture with fruit trees, for example, seasonal water shortages during the dry season can negatively affect fruit fill and the production of fruit buds for next years’ harvest. Irrigation is justified in such a situation if the trees are being managed for fruit production. Water competition may not be as critical for timber silvo-pastures.

Sometimes trees are planted in single or multiple rows along the edge of a field to reduce wind effects on crops or livestock. These are called windbreaks or shelterbelts, and have been shown to reduce wind impact over a horizontal distance equalling at least ten times the height of the trees. Wind and water erosion are reduced, creating a moist, more favorable microclimate for the crop. In the rain season the windbreak traps rain water and crops or livestock are protected from chilling winds. Beneficial

Agroforestry involves combining a tree planting with another enterprise such as grazing animals or producing mushrooms or managing woodland for a diversity of special forest products. For example, an agroforestry system might produce firewood, fruits, fodder for grazing animals, and other traditional forestry products. At the same time, the trees are sheltering livestock from wind or sun, providing wildlife habitat, controlling soil erosion, and in the case of most leguminous species fixing nitrogen to improve soil fertility. The Milenium Ecosystem Assessment associate agroforestry systems to ecosystem health. An overview of the commonly Agroforestry practices seen in Tanzania is presented here.

Agro-forestry science in the 1970's and 80's was dominated by Alley-cropping, which involves growing crops for example maize, sorghum, forages, vegetables, etc. between trees planted in rows. The spacing between the rows and after chemical use when animals must be withdrawn from the area. In alley cropping agroforestry system, a cut-and-carry livestock feeding systems could be the better management practice than grazing.

Tree and pasture combinations are called silvo-pastoral agroforestry. Hardwoods and/or pines are planted in single or multiple rows, and livestock graze between them. Although both the
insects find permanent habitat in windbreaks, enhancing crop protection.

Although the trees compete for available water along the edges between the windbreak and the crop rows, potentially reducing crop yield near the windbreak, it is believed that the net effect on productivity is positive. In fact, even on land which is well suited for high-value crops, a windbreak can increase the crop yield of the entire downwind field by as much as 20%, even when the windbreak area is included in the acreage total.

Windbreaks can be designed specifically for sheltering livestock. Research findings have shown the economic advantages of providing protection from wind-chill, a major stress on animals that live outside throughout the year. Reduced feed bills, increases in milk production, and improved calving success have resulted from the use of windbreaks.

Trees, grasses, and/or shrubs planted in areas along streams or rivers are called riparian buffers or filter strips. These plantings are designed to catch soil, excess nutrients, and chemical pesticides moving over the lands’ surface before they enter waterways. Such plantings also physically stabilize stream-banks. On cropland that is tiled to improve drainage, polluted water can flow directly into streams; constructed wetlands installed in the buffers can capture and clean this drainage water before it enters the stream. Trees for bi-remediation, which means using tree to remove pollutants from the environment is another emerging topic in agroforestry. Bamboo is one of the species targeted for bio-remediation in South East Asia and studies on its use in the Great Lake Basins in East Africa are underway.

Forested areas along streams fulfill other needs of the rural community at large by storing water and by helping to prevent stream-bank erosion, which in turn decreases sedimentation downstream. These areas protect and enhance the aquatic environment as well. Shading the water keeps it cooler, an essential condition for many desirable aquatic species. Buffer strips also provide wildlife habitat and can be managed for special forest products. Crop and livestock farmers, as well as local communities, should become aware of the threat that agricultural practices can pose to pure drinking water. Consequently, the central and local government authorities should have programs to assist in the design and planting of riparian buffer strips.

Besides producing fire woods, saw timber and pulpwood, woodlands can generate income from many other products. Established woodlands offer many non-timber “special woodland products” that contribute to cash flow without requiring the one-time harvest of old trees. Farmers in Western Tanzania are reaping huge benefits from indigenous fruits of Miombo woodlands through processing juices, jams and wines; this development call for research on domestication and management of such trees outside the forest, which lead to novel agroforestry systems.

Farmers can as well manage established woodlands to encourage naturally occurring edible fruits such as straw berries. Or they might plant crops adapted to the woodland type and microclimate. Growing mushrooms on logs is an excellent possibility; a canopy of either hardwoods or fruit trees will provide the shade needed to maintain moisture for fruiting. Materials for handicrafts or basketry are examples of products that can be harvested and marketed without any costs of establishment; on the production end, they may require only that the canopy be managed for optimal light conditions.

The number of products that a woodland can contribute is limited only by the owners’ imaginations and their ability to identify and exploit a profitable market; here are examples

- Fruits, nuts, berries
- Honey and other hive products
- Mushrooms
- Herbs and medicinal plants
- Materials for basket and chair making
- Plant materials as dried or fresh
- Ornamentals
- Bamboo juice “Ulanzi”
- Aromatics
- Fence-posts, firewood, smoke-wood
- Decorative or curving woods
- Dye materials
- Tree and shrub seeds, seedlings, and cuttings
- Charcoal