AGROFORESTRY SYSTEMS IN NIGERIA: REVIEW OF CONCEPTS AND PRACTICES

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ABSTRACT

The paper reviews agroforestry systems, highlighting their potential and significance with the aim of improving its adoption. Cultivating trees and agricultural crops in intimate combination with one another is an ancient practice that farmers have used throughout the world. Agroforestry can be viewed as a societal response, primarily born out of a need to fulfill immediate basic human needs of food, fuel, fodder, shelter, protection etc. Effort to define Agroforestry began in the mid 1970s and evolved rapidly as studies began on the diversity and scope of Agroforestry practices. There are three basic types of Agroforestry systems viz: Agrisilviculture (Crops + trees), silvopastoral (Pasture/animal + trees); and Agrosilvopastoral (crops + pasture + trees). Other specified Agroforestry can also be defined e.g. apiculture (bees with trees), aquaculture (fishes with trees and shrubs) and multipurpose tree lots). Agroforetry is becoming recognized as a land use system which is capable of yielding both wood and food while at the same time conserving and rehabilitating ecosystems. There is therefore the dire need for an aggressive Agroforestry extension to convince farmers to adopt this farming system, most of which is fast disappearing at the former places it was earlier practiced.

INTRODUCTION

Often called a new name for a set of old practices, agroforestry is recognized as a promising land-use technology and an interface between agriculture and forestry, especially in developing countries of the tropics and sub-tropics (ICRAF, 1997). Increased concern at the highest international policy levels about the sustainability of agricultural development, in the light of the apparent rapid depletion of the natural resources base, has brought agroforestry even further into the limelight (FAO, 2004a). In a loose sense, agroforestry began when first turned from a hunting and gathering lifestyle and took up culture. Though they may be not purposefully integrated, trees and farm crops have always occurred together in systems where subsistence was the primary farming objective (Winrock, 1995).

Human society has always has a range of strategies for sustainable survival (Canway & Barbier, 1990). Agroforestry can be viewed as one to such societal response, primarily born out of a need to fulfill immediate basic human needs of food, fuel, fodder, shelter, protection etc (Dove,1992). The term Agroforestry for social scientists, represents a combination and interrelationships between people, domestic animals, crops and trees, designed to rehabilitate land or to sustain and increase production of certain desired social benefits. Thus, Agroforestry concerns the structure and functioning of human ecosystem and not merely biophysical system (Khot, 1999). The paper therefore reviews the potential and significance of agroforestry systems with the aim of improving its adoption and practices.

ORIGIN OF AGROFORESTRY SYSTEMS

Historically, cultivating trees and agricultural crops in intimate combination with one another is an ancient practice that farmers have used throughout the world (Nair, 1979). King (1987) stated that in Europe until the middle ages, it was the general custom to clear-fell degraded forest, burn the slash, cultivate food crops for varying periods on the cleared area and plant or sow trees before, along with, after sowing agricultural crops. This "farming system" is no longer popular in Europe (King, 1987).

In Central America, it has been a long time traditional practice for farmers to plant an average of two dozen species of plants on plots larger than one-tenth of an hectare. For example, a farmer would coconut (*Cocus nucifera*) or Pawpaw (*Carica papaya*) with a lower layer of bananas or Citrus, a shrub layer of coffee or cacao, annuals of different stature such as maize and finally a spreading grown cover such as squash. Such an intimate mixture of various plants, each with a different structure, imitated the layered configuration of mixed tropical forests (Wilken, 1977). In Asia, for example the Philippines, a complex and somewhat sophisticated type of "shifting cultivation" were practiced. In clearing the forest for agricultural use, they deliberately spared certain trees which by the end of the rice growing season provided partial canopy of new foliage to prevent excessive exposure of the soil to the sun. These were an indispensable farming system here and were either planted or preserved from the original forest to provide food, medicines, construction wood and cosmetics (Conklin, 1957). These satisfy the socio-economic and environmental benefits of Agroforestry practices. The situation was a little different in Africa. For example in Southern Nigeria, Nair (1993) reported that yams, maize, pumpkin and beans were typically grown together under a cover of scattered trees. He observed that the Yoruba of Western Nigeria have long practiced an intensive system of mixing herbaceous plants, shrubs and trees crops, claming that the system is a means of conserving human energy by making full use of the limited space won from the dense forest. The Yoruba also claim that this system is an inexpensive means of maintaining soil fertility as well as combating erosion and nutrient leaching (Ojo, 1966).

There are innumerable examples of traditional land-use practices involving combined production of trees and agricultural species on the same piece of land in many parts of the world. These are some examples of what is now known as Agroforestry (Nair, 1993). However, by the end of 19th century Myanmar established Teak (T*ectona grandis*) plantation by using a method called "Taungya" which later became the most efficient way of planting Teak. It was introduced into South Africa as early as 1857 and was taken from Burma to India in 1890 (Hailey, 1957). The ruling philosophy of the Taungya system was to establish forest plantations whenever possible using available unemployed or landless labourers. In return for performing forestry tasks, the labourers would be allowed to cultivate the land between the rows of tree seedlings to grow agricultural produce. This is a simplification of a system whose detail varied depending on the country and locality (Nair, 1993).

Modern Agroforestry and Concerned Organization

Faced with the problems of deforestation and environmental degradation in the tropical regions, individuals and institutions intensified their search for appropriate land use approaches. These would not only be an additive to traditional land-use practices but also socially acceptable, ensure the sustainability of the production based and meet the need for production of multiple outputs. Efforts to design major programmes which would allow local communities to benefit directly from forests, paved the way for new forestry concepts such as social forestry in many countries (Nair, 1993). One of the approaches was experimentation in the general field of intercropping and in particular, it was felt that there was a need for a more scientific approach to intercropping research. It was suggested that greater effort were needed with respect to crop physiology, agronomy, yield stability, biological nitrogen fixation and plant protection (Nair, 1979). Consequently, the International Institute of Tropical Agriculture (IITA) extended its work to include integration of trees and shrubs with crop production. Other research organizations had also initiated serious work on, for example, the integration of animals with plantation of tree crops such as rubber and the intercropping of coconuts with legumes (Nair, 1979).

The most significant single initiative that contributed to the development of Agroforestry came from International Development Research Centre (IDRC) of Canada. The IDRC Project Report recommended the establishment of an internal organization which would support, plan and coordinate on a world-wide basis, research combing the land-management systems of agriculture and forestry. Consequently, the International Council for Research in Agroforestry (ICRF) was established in 1977. In 1991, it was renamed the International Centre for Research in Agroforestry (ICRAF) and charged to play a leading role in collecting information, conducting research, disseminating research result and pioneering new approaches and systems (Nair, 1993).

Concept of Agroforestry

Effort to define Agroforestry began in the mid 1970s and evolved rapidly as studies began on the diversity and scope of Agroforestry practices. In the late 1970s and early 1980s, the fate of Agroforestry suffered from a surfeit of definitions and a general lack of common understanding caused by a paucity of information. These earlier struggles to define a broad new area of study have resulted in a conceptual understanding from which to examine complex systems and practices. At least, one other early definition summarizes the basis fo the study of Agroforestry.

Agroforestry is thus defined as a sustainable management system for land that increases total production, combines agricultural crops, and forest plants and/or animals simultaneously or sequentially and applies management practices that are compatible with the cultural pattern of the local population (Bene *et al*, 1977).

However, among the many efforts to define the art and science of Agroforestry, the following is perhaps the most appropriate: "Agroforestry is a land sustain use that involves deliberate intention, introduction or mixture of trees or other woody perennials in crop/animal production fields to benefit from the result ecological and economic interactions (Nair, 1984).

Each of the above definitions has limitations; several basic ideas can be drawn from them:

Agroforestry is a distinct land-use

system which may include combination of agricultural, forestry, horticultural and animal husbandry subsystems and practices. Simply stated, Agroforestry is a means of managing or using land (i.e., a multiple land-use system) that combines trees or shrubs with agricultural or horticultural crops or livestock (i.e., subsystem).

Agroforestry integrates trees with crops and/or animals with the main objectives of reducing risk and increasing total productivity. Farmers have historically used indigenous mixed cropping practices to minimize the risk of total crop failure by growing a variety of products on the same piece of land.

In their ideal forms, Agroforestry systems are both stable and sustainable. Agroforestry practices have greater diversity than do monoculture practices and can distribute production over a longer period. This provides income that is more regular with increased cash flow stability.

To farmers, particularly those who may have difficulty storing or marketing farm produce.

Integration of trees into agricultural systems may result in more efficient use of sunlight, moisture and plant nutrients than is generally possible by monocropping of either agricultural or forestry crops.

However, the concepts of Agroforestry have been well elucidated in several publications. Today, there is no divergence of opinion that Agroforestry.

- Is a collective name for multiple land-use systems involving trees combine with crops and/or animals on the same unit of land;
- Combines production of multiple outputs with protection of the resource base;
- Places emphasis on the use of indigenous, multipurpose trees and shrubs;
- Is particularly suitable for low input condition and fragile environments;
- Involves the interplay of socio-cultural values more than in most other land-use systems; and
- Is structurally and functionally more complex than monoculture.

Nevertheless, ICRAF continued to define Agroforestry as new research findings emerge. In their most recent definition of Agroforestry, ICRAF(1997) sees Agroforestry as a dynamic, economically based, natural resources management system that through the integration of trees on farms and in agricultural landscape diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels, thus, Agroforestry, often paraphrased as "a new name for an old practice" is no longer a "new term". It is widely accepted as an approach to landuse involving a deliberate mixture of trees with crops and/or animals.

Types of Agroforestry Systems in Nigeria

Young (1989) reported that there are hundreds, possibly thousands of Agroforestry systems but only 20 distinct practices. These systems, existing in different places, are so complex and diverse that they need to be grouped and classified into different categories in order to evaluate them and develop some action plans for their improvement. These Agroforestry systems were thus classified into system's structure (composition and arrangement of components), functions, socio-economic

scale of management and ecological spread. However, there are only three basic sets of components that are managed in all Agroforestry systems, namely: woody perennial (usually referred to as "trees"), herbaceous plants or "crops" and animals. A logical step is to classify Agroforestry systems based on their component composition (Nair, 1991). Thus, there are three basic types of Agroforestry systems viz:

1. Agrisilviculture (Crop + Trees)
2. Silvopastoral (Pasture/animal + Trees)
3. Agrosilvopastoral (Crops + Pasture + Trees).

Other specified Agroforestry can also be defined e.g., apiculture (Bees with trees), aquaculture (Fishes with trees and shrubs), and multipurpose tree lots. Although several Agroforestry systems have been recorded from around the world, the distinct Agroforestry practices that constitute these systems in various biomes and locations are only few. Of course, same or similar Agroforestry practices can be found in Agroforestry systems in different places.

The varieties and descriptions of Agroforestry systems practiced in Nigeria are presented in table 1.

Table 1: Var ieties and description of Agroforestry practices (systems) in Nigeria

S/N	Agroforestry system	Description	Remarks
A	Taungya Farming	Food crops are interplanted with trees in a unit area of land for 2-3 years. Food crops cease to exist on the land when the tree crops close canopy. The system has proved effective in providing food for forestry workers and forage for cutting by cattle rearers.	Main Agroforestry model practice in the Forest Reserves since 1950 to date. Most of the State owned artificial plantations now being exploited were raised through the Taungya system (Igugu and Osemeobo, 1995). The chief problem with this system is the need to plan a planting programme for long cycle trees with three or four years of crops.
B	Integrated Taungya	Similar to Taungya farming, but here, when the tree canopy is closed, livestock grazing substitute raising of agricultural crops	The integrated approach aims at invoking the idea of land use practice whereby the activities on the land is stretched all the y ear round (Rander, 1988).
C	Improved Fallow in Shifting Cultivation	Introduction of cover crops on the farmland in an effort to minimize soil degradation associated with agriculture	The role of this system is mainly that of soil conservation and impro vement. The soil amelioration because of the system leads to increase in crop yield during then cropping period.

D	Alley-cropping (hedge row intercropping)	In this system, arable crops are grown between hedgerows of planted shrubs and trees, preferably *eguminous* species that are periodically pruned to prevent shading of the companion crops and the pruning applied as mulch for the crops.	This is a relatively new technique developed at IITA and ICRAF. The tree provides nitrogen from atmospheric fixation, r ecycle nutrients from the depth of soil, suppress weeds and increase organic matter content of the soil.
E	Alley farming	Trees, shrubs and other perennials are planted with agricultural crops to supplement the woody plants in the rows.	It is focu sed on livestock production. Alley farming was designed mainly for sheep and goat grazing. The advantages are that the land provides crop residues and controls soil erosion through windbreak. Major disadvantage is the competition of hedgerows with crops fo r soil water, which is often limiting crop productivity (Singh *et al,* 1989).
F	Shelterbelts	Agroforestry system in which food crops are planted between rows of trees belts planted as shelter. The trees and shrubs are planted in one or more rows at right angle to prevailing winds	The practice often increases crop yield because of their beneficial effects on soil and microclimate. The effect on animals is to reduce stress from heat and wind. Disadvantages of the system are that labour involvement is enormous and species used as hedgerow crops are without edible by products.
G	Windbreaks	Here, double rows of trees are planted around the boundary of a food crop farm on the windward side. Each windbreak is 150m long with 100 trees planted at escapement of 3m x 3m.	The advantage is that windbreaks reduce wind erosion and at the same time produce forest alongside food crops.
H	Home Garden	Tropical home gardens consist of an assemblage of plants which may include trees, shrubs, vines and herbaceous plants growing in or adjacent to a homestead or home compound	Okafor and Fernandes (1989) reported that in this system, multipurpose trees and shrubs in a multi -storey association with agricultural crops are raised with small livestock in homesteads. Home garden is not a formal practice of Agroforestry but a traditional farming system with an Agroforestry focus.

I	Multipurpose trees on cropland (Trees on farmland or farm forestry)	Farmers intentionally lea ve few trees on farms when clearing the land in the practice. The trees commonly left are those of economic importance to the farmers.	There is also deliberate planting desirable fruit bearing trees (fruit trees) on farmlands where the density of the nat ural tree is low. Other terms with Forestry endings are community forestry a form of social forestry which refers to tree planting activities undertaken by a community on communal lands or the so -called common peoples direct participation in the proce ss, either by growing trees themselves or by processing the tree products locally.
J	Trees in Social conservation	Woody plants, whether in hedges or not, planted to stabilize the soil on terrace edges and other conservation	Woody perennials can great ly assist infiltration and reduce surface water run-off, although a wrong choice of species or poor planting technique can have the opposite effect
K	Aquaforestry	Is a practice that links trees with aquacultu re. Trees are planted around fishponds to provide fodder for herbivorous fish.	The trees serve as shelter and shade which create a desirable microclimate for the pond. Widely practiced by traditional farmers in inland watercourses where the farmers have full rights to the land.
L	Apiculture (api-silviculture)	Carefully chosen woody species grown for their nectar-producing flowers and pollen valued by bees can boost wax and honey production.	If flowering is staggered, allowing the bees to work as long as there are flowers instead of only working for a few months in a year.
M	Protein Bank	Woody perennial vegetation judiciously used helps to supply forage during dry seasons or years of low rainfall.	Not only does it provide green forage when the grass cov er has withered but it can also supply more protein than grass. The advantage of woody plants in dry season is therefore both quantitative and qualitative.

Adapted from Baumer (1990)

Why are agroforestry systems more productive?

Agroforestry system are considered more productive because:

They use limited resources more efficiently;

Multi-storied cropping systems absorb sunlight at all levels;

Deep tree roots take up soil nutrients and moisture that are out of reach of root crops;

Trees shelter crops and soil surfaces from drying winds and intense sun. Tree-leaf mulch retains moisture in upper soil layers; and

Trees serve to continuously sustain rather than periodically rebuild soils. Fallow requirements are reduced, leaving more land in production at any one time.

Baumer (1990) summarized the socio-economic and environment benefits of Agroforestry farming systems as follows:

Contribute to the supply of firewood better than mono-cropping;

Woody perennials are less affected than herbaceous plants by temporary water deficit and hence Agroforestry farming systems make it possible to increase directly or indirectly the production of food both in quality and quantity, notably by greater product diversity;

Through product diversification, they also contribute to increased stability in food supply;

Their effect on the environment is positive and lasting, contribute to the maintenance of fertility of soils, reduce wind speeds, create microclimates favourable to crops and to load capacity;

Woody perennials in Agroforestry farming systems are chosen not only because they give wood, they also provide tannins, flowers, medicines, dyes, etc;

Agroforestry farming system contribute to the improvement of economic and social conditions in rural areas, not only by increasing profitability, sustainability and crop security buy also by creating jobs;

Agroforestry farming systems encourage cultural exchange by combining traditional experiences with advanced technologies and by researching modern solutions that are compatible with the socio-cultural customs of the populations concerned.

Contribution of Agroforestry in Rehabilitation of Degraded Land

Monoculture as practiced in developing counties such as Nigeria requires high yielding crop varieties and an intensive use of fertilizers for optimal or acceptable performance of the crops. These inputs are not forth-coming in many situations together with the fact that tropical soils are exhausted more easily than temperate ones. The peasant farmer is then caught between unachievable agricultural technological innovations and the much-derided traditional system. An attempt to embrace the more promising modern system usually leaves its mark on the environment. While indicting agriculture for deforestation, Okigbo (1983) upholds Agroforestry as an integration of compatible components of forestry and agricultural production. This means that Agroforestry has the potential to replace the destroyed forests.

Unruh *et al* (1993) noted that a rehabilitation and management of degraded lands with appropriate Agroforestry systems is a significant global opportunity which has not been realized, especially in the effort to

reduce accumulation of green house gases in the atmosphere. Agroforestry is therefore a means of correcting the effects of degradation. Hanson *et al* (1995), Shultz *et al* (1995), and Onwusu (1993) agreed that Agroforestry can provide new and useful solutions to many of the consequences of human land use, including increased desertification of agricultural production system, increased yield of crops and livestock, reduction of non-point source pollution and increased rural development by contributing to an ecosystem-based management system that guarantees sustainability and environmental quality. Agroforestry should therefore be seen as a system that addresses the declining quality of the environment, including the soil, while also increasing the variety of produce by the farmer. This will not only increase the farmers' income but also help ensure food security and balance nutrition.

Ecological Benefits of Agroforestry

Ecology concerns the relationship between organisms, their habitat and the environment. It outlines the various inter-relationship existing among the components of the system. Nature has a way of maintaining and regenerating natural resources as they are utilized. This is done through a series of cycles which connect the various components of the system and their activities in the environment. Agroforestry is a land management practice with consideration for the natural process of soil nutrient renewal. Charley and West (1977) claimed that the litter fall is the major pathway for the return of nitrogen, phosphorus, calcium and magnesium to the soils. This implies that cultivation of perennial shrubs and trees would allow leaf-fall onto the soil, subsequently decomposition of which would enrich the soil.

It can therefore be asserted that the protection of the soil from direct rays of sunlight also complement nutrient conservation, as the rate of oxidation of soil nutrient will reduce. This is in addition to the protection from erosion and fire protection provided by the trees (Hochbeg *et al*, *1994*). Danell (1986) added that the decomposition of fine shallow roots enrich the top soil with nitrogen. The Great Wall of China is only a forest plantation which checked the advancing Gobi desert successfully. The same idea was used in the Tahoma region and Maggia valley of Niger. The WIDE (a programme in Mauritania) assisted the people of Boutilimit in Mauritania to establish forest trees on their farms to reclaim degraded land (Adekoya, 1997). Agroforestry therefore contributes towards maintenance of the ecological balance which is the basis for environmental sustainability.

Furthermore, climatic changes, global warming or the greenhouse effect caused by environmental degradation can be checked with Agroforestry practices. Anderson (1990) emphasized that Agroforestry plays a major role in reclamation of degraded or abandoned lands and is a workable approach to mimic natural succession and increased biodiversity. Ostyina (1993) gave a detailed account of how deforestation occurred in Shinyanga but soil conservation and afforestation programmes reclaim the vegetation. The recognition of the potentialities of Agroforestry have inspired the Portuguese and French governments to pass legislations that are aimed at protecting forest areas and natural habitats (OECD, 1991). The main concept here is allowing soil stability by reducing the extent of clearing and tillage thereby reverting the trend of environmental disequilibrium. It should be noted that there is a tolerance limit to human interference for soil substrates, surface and underground

water, the flora, fauna and microorganism (Otzen, 1992). The role of the soil in providing a base for the sustenance of life in all forms needs to be appreciated. Hence, the role of Agroforestry in ensuring sustainable use of the land, upholding ecological equilibrium and maintaining the environment should be put in the right perspective.

Profitability issue in Agroforestry

Agriculture is more than business; it is a way of life, a means of survival and a determinant of well being of future generations. However, it demands the utilization of some inputs which are later measured against the generated input. Profit is declared when the output surpasses the input on the same scale. Agroforestry is both corrective and conservatory and the profit can best be measured in terms of attainment of the objectives of the programme. Sanchez (1995) explained that Agroforestry is about putting money in farmers' pockets in additional to the goals of providing food security, enhancing soil fertility, conserving soil water as well as increasing fodder and fuelwood production. The profit from Agroforestry is therefore in economic and environmental terms, the latter being difficult to measure in monetary terms. In conserving natural resources, Agroforestry ensures a stable agricultural production. Although the yield from Agroforestry may be slightly lower than when fertilizer is used. Shannon *et al* (1990) proved that the yield is stable but latter declined seriously and steadily despite additional fertilizer.

While Agroforestry systems usually entail more labour, the resultant decrease in the use of inputs like fertilizer offset the extra labour changes resulting in an attractive net income and marginal rate of return per unit cost (Ngambeki, 1985). In other words, Agroforestry profit is observed more as an opportunity cost in terms of losses that would have been incurred if Agroforestry were not employed. The damage done through inappropriate practices are felt only after some years, therefore effects of Agroforestry cannot be immediate. Under real farmers' conditions, it might take years before the tangible benefits become apparent (AFNETA, 1990). The farmer may therefore require some encouragement to devote land and energy to Agroforestry practices.

The need for Indigenous Agroforestry System

The variability exiting among vegetation zones, peculiar environmental problems, farming systems, land use patterns and tenurial rights call for a different Agroforestry system that would be adaptable and adoptable in each community. This calls for contribution in terms of information from the farmers.

On-farm research and development activities need to be carried out in all situations to fine-tune the technology, assess its productivity and efficiency relative to traditional farmer practice and determine farmer interest, acceptability and potential, for further development. Foley and Bernard (1984) advised greater emphasis on diagnosis of the Agroforestry situation to develop adoptable designs. As Agroforestry is basically a solution to developed problems, an understanding of the indigenous system would lead to what can be done to remedy the situation. This would require in addition to others, animals and farming systems (Huxley, 1983).

Agroforestry practices are not new, but they are in vogue because they offer potentials for sustainable development (Berkowitz, 1994). The importance of the farmers' indigenous practices lies in the fact that recent techniques have contributed to environmental degradation, so there is a need to retrace steps and build upon indigenous knowledge. It

could be further recognized that plants and animals existing in a region are not there by chance but have become adapted to the environment and other species. The indigenous species are also acceptable and familiar to the people.

Conclusion

Today, Agroforestry instead of being merely the handmaiden of forestry is being used more as an agricultural system, particularly for small-scale farmers. The potential of Agroforestry for soil improvement and conservation is generally accepted. Indeed, Agroforestry for soil improvement and conservation is generally accepted. Indeed, Agroforestry is becoming recognized as a land use system which is capable of yielding both wood and food while at the same time conserving and rehabilitating ecosystem. There is therefore the dire need for an aggressive Agroforestry extension to convince farmers to adopt this farming system, most of which is fast disappearing at the places it was earlier practiced.

References

Adekoya, A.E. (1997): An analysis of Farmers' participation in Agroforestry in Oyo State, Nigeria. Unpublished Ph.D. Thesis, Department of Africultural Extension, University of Ibadan, Nigeria 19pp.

AFNETA (1990): Alley-Farming Net-Work for Tropical Africa (AFNETA), Vol. 2, No. 3.p.7.

Anderson, A.B. (ed) 91990): Alternative to Deforestation: Step Towards the Sustainable use of Amazon Rainforest. New York. Columbia University Press. 281pp.

Baumer, M. (1990): Agroforestry and Desertification. The Netherlands. Technical Center for Agricultural and Rural Cooperation. 250pp.

Bene, J.G., Beall, H. W and Cote, A. (1977): Trees, Foods and people. Ottawa, Canada, IDRC. 89pp.

Canway, G.R. & Barbier, E.B. (1990): After the Green Revolution: Sustainable Agriculture for Development. London Earthsean Publications Ltd. Pp 15-59.

Charley, J.L. and West, N.E. (1977): Micro-Pattern of Nitrogen Mineralisation Activity in soil of some shrub dominated ecosystems of Utah. Soil Biochemistry Journal No. 9, pp 357-365.

Conklin, H.C. (1957): Hanunoo Agriculture, Rome Italy. Food and Agricultural Organisation.

Danell, K. (1986): "Nitrogen in Shoot Lither, Root Lither Exudates from Nitrogen fixing Alnus incana". Plant and Soil 91, pp 43-49.

FAO (2004): State of the World Forest. FAO Rome. 74 pp.

Foley, G. & Bernard, G. (1984): Farm and Community Forestry, London Earthscan Publications, pp. 61-68.

Hailey, L (1957): An African Survey. Oxford University Press, UK. Pp 10-14.

Hanson, J.C., Kanffman, C.S., and Schaver, A (1995): Attitudes and Practices of Sustainable farmers with application to designing a Sustainable Agricultural Extension Programme". Journal of Sustainable Agriculture Vol. 6, Nos. 2 and 3, 9 147.

Hochberg, M.E., Menant, J.C., and Gignoux, J. (1994): "The influence of Tree Biology and Fire in the Spatial Structure of the West Africa Savannah". Journal of Ecology Vo. 82, No. 2. p 73.

Huxley, P.A. (1983): "Comments on Agroforestry Classification with Special Reference to Plant Aspects". In: Plant Research and Agroforestry. ICRAF , Nairobi, Kenya. P95.

ICRAF (1997): International Centre for Research in Agroforestry (ICRAF) Medium Term Plan 1998-2000, 1- 5pp.

Igugu, G.O. and Osemeobo, G.J. (1995): The Impact of Forestry in Improving Small-holder land use for Agricultural Production in Nigeria. Oduwaye (Ed) Proceedings of the 24 Conference of FAN, Forestry and the Small-scale Farmer Kaduna, Kaduna State, 30 October 4 November, 1995. pp 135-137.

Khot, S. (1999): Socio-Economic Aspects of Agroforestry adopted by BAIF Unpublished electronic version. BAIF Development Research Foundation home page. Accessed on 24/09/2005.

Kings, K.F.S. (1987): The History of Agroforestry. In Steppler, H.A. and Nair, P.K.R. (Eds), Agroforestry a Decade of Development, Nairobi, Kenya. ICRAF, pp1-11.

Nair, P.K.R. (1979): Intensive Multiple Cropping with Coconut in India, Berlin, Germany. Verlag Paul Parley.

Nair, P.K.R., (1993): An Introduction to Agroforestry. The Netherlands. Kluwer Academic Publishers, 499pp.

Nair, P.K.R., (1984): Fruit Trees in Agroforestry. Working Paper. Environment and Policy Institute Nairobi, Kenya: East-West Centre, Honolulu, Hawaiii, USA.

Nair, P.K.R., (1991): State-of-the-art of Agroforestry Systems. In: Jarvis, P.G. (ed) Agroforestry Principles and Practices. The Netherlands: Elsevier Science Publishing Company. Pp 5-10.

Ngambeki, D.S. (1985): "Economic Evaluation of Alley Cropping Leucaena with maize Maize and Maize Cowpea in Southern Nigeria". Agricultural Systems Vo. 17, pp 243-256.

OECD (1991): The State of the Environment. Organization for Economic Corporation and Development (OECD), Paris, 225 pp.

Okafor, J.C. and Fernandes, E.C.M. (1989): Compound farms of Southern Nigeria. Agroforestry systems 5: pp 143- 168.

Okigbo, B.N. (1983): "Plants and Agroforestry in land use System of West Africa. In: Huxley, P.A. (ed) Plant Research and Agroforestry. Nairobi, Kenya. ICRAF, pp 25-42.

Ojo, G.J.A. (1966): Yoruba Culture. London, Uk, University of Ife and London Press. Pp 7-10.

Onwusu, O.Y. (1993): Farm Based Agroforestry; Four Years Experience in Ghana. Agroforestry Today, Vol. 5, No. 1, pp 8-10.

Otsyina, R.M. (1993): World Agroforestry

and Afforestation risk. Tse-Tse Fly Reinvasion? Agroforestry Today, Vol. 5 (1), pp 6-8.

Otzen, U. (1992): Land is life. Concept, Requirements and measures to ensure sustainable agricultural development. Intermediate Technology Publications, pp 49-59

Rander, H.S. (1988): Agroforestry Systems in Nigeria. Paper Presented at the National Workshop on Agroforestry Ibadan, Nigeria; August, 1988.

Schultz, R.C., Colletti, J.P., and Faltonson, R.R. (1995): "Agroforestry Opportunities for the United States of America". Agroforestry Systems, Vol. 31, No. 2, pp 117- 132.

Shannon, D.A., Kabaluapa, K.N. and Ngoyi, M.L. (1990): Alley Cropping stabilizes maize yields in Bandajika Zaire AFNETA, Vol. 2, No. 1, pp 8-9.

Singh, R.P. Ong, C.K. and Saharan, N. (1989): Microclimate and growth of sorghum and Cowpea in Alley Cropping in Semi-arid India. Agroforestry Systems 9. pp 259-274.

Unruh, J.D. Houghton, R.A. and Lafebure, P.A. (1993): "Carbon Storage in Agroforestry: An estimate for sub-saharan Africa". Climate Research 3. pp 39-52

Wilken, G.C. (1977): Integrating Forest and Small Scale farm System in Middle America. Agro ecosystems 3, pp 291-302.

Winrock (1995): Agroforestry for the Pacific Technologies Fact- Sheets of the Agroforestry Information Service Nrs 1-15 and Agroforestry Species Highlights Nrs 1-2. 58 p.

Young, A. (1989): Agroforestry for Soil Conservation. United Kingdom. CAB International, p 11.