

Agroforestry Bibliography

Arnold, J.E.M. 1987. "Economic considerations in agroforestry." pp. 173-189. In, *Agroforestry: A Decade of Development*. Eds. Steppler, H.A. and P.K.R. Nair. International Council for Research in Agroforestry, Nairobi, Kenya.

- outlines main benefits, costs, and production objectives through identifying economic considerations that caused farmers to adopt certain agroforestry systems
- systems covered include; homegardens, farm woodlots, shifting cultivation, and alley cropping
- lists several examples of agroforestry practices, giving constraints/opportunities, farmer response, and the contribution of agroforestry
- lists five common farmer strategies, found in conditions of limited resources and high susceptibility to risk, involving adoption of agroforestry
- farmers' lack of access to capital was a common deterrent to increasing land or labor resources

Bonnard, P., and S. Scherr. 1994. "Within gender differences in tree management: Is gender distinction a reliable concept?" *Agroforestry Systems*. **25**: 71-93.

- explains how gender is sometimes useful in project design and analysis, but basing design and assessment on simple gender distinctions can be faulty because there are certain fundamental differences among women producers in agroforestry that are not captured by this method
- highlights the need to go beyond these simple distinctions and look at additional stratifiers such as access to resources, use rights, and control over benefits
- conclude that choices made in agroforestry implementation, species use, and tree product use were more clearly differentiated by marital status of women

Burley, J. 1987. "Exploitation of the potential of multipurpose trees and shrubs in agroforestry." In, *Agroforestry: A Decade of Development*. pp. 273-287. eds. Steppler, H.A. and P.K.R. Nair. International Council for Research in Agroforestry, Nairobi, Kenya.

- author groups agroforestry systems into eleven different systems and describes and gives products of each one
- lists benefits from trees and shrubs, the research needed for exploitation of MPTS potential, and groups major stages and problems related to the incorporation of MPTS into four topics (genetic variation, germplasm supplies, assessment of multiple products and services, and crop management)
- **Tables included:** "Distribution and phenological characteristics of semi-arid species in the OFI international network", "Use and characteristics of semi-arid species in the OFI international network", "Summary of seed collection site data for the OFI international network of *Gliricidia* species and provenance trials", **Appendix I** "Major steps and technology components in tree and forestry research to develop appropriate land-use systems".

Castro, A.P.1993. "Kikuyu agroforestry - An historical analysis." *Agriculture, Ecosystems, and Environment*. **46:(1-4)** 45-54.

- provides historical analysis of indigenous agroforestry practices among Ndia and Gichugu Kikuyu farmers in Kirinyaga District, Kenya
- examines how indigenous agroforestry was modified by state forestry, agricultural, and land use policies and programs

- communal tree management strategies have collapsed, but indigenous farm forestry practices remain a resilient and viable part of contemporary land use strategies

Current, D., E. Lutz, and S.J. Scherr. 1995. "The Costs and Benefits of Agroforestry to Farmers." *The World Bank Research Observer*. **10(2)**: 151-180.

- describes case studies of 21 agroforestry projects in six Central American and two Caribbean countries
- focal point of analysis was the profitability of agroforestry for farmers as a crucial incentive to adoption
- concludes that many agroforestry practices are profitable under a range of conditions and are likely to be widely applicable, and indicates that successful projects work with locals, responding to their needs, and offering them a wide variety of species and systems from which to choose
- demonstrations and technicians have been useful methods of technology transfer, and research is essential in identification of regional suitable practices
- government regulation of tree harvesting and insecurity of tenure are disincentives to adoption

Ehui, S.K., B.T. Lang, and D.S.C. Spencer. 1990. "Economic Analysis of Soil Erosion Effects in Alley Cropping, No-till and Bush Fallow Systems in South Western Nigeria." *Agroforestry Systems*. **34**: 349-368.

- analyzed five alternative land-use systems to determine their profitability considering the short- and long run impact of soil erosion on agricultural productivity and using a capital budgeting approach based on a simulation model
- using a ten percent discount rate, found that the 12 year cycle shifting cultivation system was the most profitable, followed by the 4m alley cropping, the no-till, the 2m alley cropping and the 6-year cycle shifting cultivation systems
- conclude that where farmers have access to costless new forest land, slight yield damage created by erosion will not significantly lower the immediate profit advantage of traditional bush fallow systems, with long fallow periods
- also noted, however, that because of the lack of resource characteristics and basic constraints with which farmers usually work, this study does not provide sufficient information regarding the potential for integration of alternative land use systems within *existing* farming systems
- a whole-farm approach is necessary to accurately test stated results

Fortman, L., and D. Rocheleau. 1985. "Women and agroforestry: four myths and three case studies." *Agroforestry Systems*. **2**: 253-272.

- discusses how women are frequently ignored in the design of agroforestry projects because of certain commonly held myths involving their participation in all aspects of life (production decisions and social activities)
- presents case studies from the Dominican Republic, India, and Kenya that demonstrate women's involvement in agroforestry from implementation to women's importance in mobilizing communities
- discusses considerations for including women more in agroforestry projects

Gutteridge, R.C., H.M. Shelton. 1993. "The scope and potential of tree legumes in agroforestry." *Agroforestry Systems*. **23:(2-3)** 177-194.

- reviews role of tree legumes in agroforestry, especially for fodder purposes
- outlines areas of current research focus

- highlights gaps in legume knowledge that require further research effort

Hamilton, P.C., L.R. Chandler, A.W. Brodie, and J.P. Cornelius. 1998. "A financial analysis of a small scale *Gmelina arborea* Roxb. Improvement program in Costa Rica." *New Forests*. **16**: 89-99.

- describes a financial analysis of a small-scale improvement program using *Gmelina arborea* in Costa Rica
- gives total discounted/compounded costs of the program and annual planting rates using a 5% discount rate
- suggests that the implementation of such small-scale, local programs by community-based or locally oriented organizations might often be justifiable, given enough genetic gain
- recommends that tree improvement activities beyond the seed stand level be implemented as a routine element of small-scale planting programs

Kass, D.C.L. 1993. "Tree domestication for agroforestry - present status and future directions." *Agroforestry Systems*. **23**:(2-3) 195-205.

- discusses 7 activities that constitute tree domestication and considers the contribution of each to the current makeup of trees used in agroforestry [(1) manipulation of tree populations by silvicultural practices, (2) enhancement of site productivity, (3) control of destructive agents, (4) evolution of trees under natural selection, (5) semi-natural selection for survival in the socio-agricultural circumstances in which trees are grown, (6) conscious human selection for desired characteristics, and (7) correlated response to selection]
- discusses current problems faced by existing tree improvement programs, including: high demand for MPTS; high cost and slow process of current methods; improvement programs with too few species
- considers more involvement of farmers in the selection and testing processes and MPT propagation as a solution

McAdam, J.H. 1991. "An evaluation of tree protection methods against Scottish Blackface sheep in an upland agroforestry system." *Forest Ecology and Management*. **45**: 119-125.

- presents an experiment that evaluates protection methods of three tree species (*Acer pseudoplatanus*, *Fraxinus excelsior*, and *Larix decidua*) from sheep in the uplands of the British Isles
- eight tree protection options were evaluated
- concluded that, where tie quality and security were improved, a 1.8 m primary stake, short secondary peg and 1.5 m round section shelter would give the most cost effective protection from sheep

Nair, PKR., and B. Lundgren. 1985. "Agroforestry for soil conservation." In, *Soil Erosion and Conservation*. Eds. El-Swaify, S.A., W.C. Moldenhauer, and A. Lo. Soil Conservation Society of America, Ankeny, IO.

- discusses scope and potential of agroforestry, its problems and constraints including lack of multidisciplinary approach, lack of resources (monetary and human) for extension, and boundaries and competition in government and non-governmental agencies
- states factors that restrict implementation of agroforestry on a large scale in rural areas (i.e. reaching farmers with information, convincing farmers to adopt new land use practices, and helping farmers overcome constraints)

- discusses the notion that not enough knowledge has been built up on the soil conservation issues of agroforestry
- analyzes conservation role of woody perennials such as; soil fertility improvement, increased organic matter, improvement of soil physical condition, role in erosion control, and notes the protection of water catchment areas, importance to ecosystem stability, reducing flood damage, and other conservation aspects of trees
- discusses benefits of soil management for conservation, naming certain components of low-input soil management systems for exploiting soil conservation benefits of agroforestry
- discusses traditional soil conservation and highlights its emerging principles: high input technologies are not appropriate; soil protection practices, such as mulching, fallows, cover crops, produce much more favorable results in the tropics than in temperate regions; and soil and water conservation efforts in the tropics require a more interdisciplinary approach
- points out that there are three main differences between the tropics and temperate regions as far as soil conservation is concerned: (i) higher intensity rainfall, (ii) soils with a strong dependence on organic matter for fertility and structural maintenance, and (iii) continuously high temperatures leading to high evapotranspiration and rapid biological processes; describes the role of agroforestry and lists its research needs and authors' recommendations

Owino, F. 1992. "Improving multipurpose tree and shrub species for agroforestry systems." *Agroforestry Systems*. **19(2)**: 131-137.

- introduces need for tree improvement strategies in agroforestry extension
- gives steps to follow in tree improvement
- lists main criteria for selecting high priority agroforestry tree species for research and development
- illustrates manner of doing so with real-life example
- indexes a number of species and their proper zones for future use
- highlights supposed differences in tree improvement programs in industrial and non-industrial use

Owino, F. 1996. "Selection for adaptation in multipurpose trees and shrubs for production and function in agroforestry systems." *Euphytica*. **92**: 225-234.

- highlights specific adaptations in tree-soil relations
- experiments are performed on a fodder species (*Caliandra calothyrsus*) and a timber species (*Grevillea robusta*)
- study on *G. robusta* performed to determine variations in root growth patterns and correlations between stem and root growth for potential of indirect selection for root growth characteristics --results indicated weak correlations between root and shoot growth
- test on *C. calothyrsus* was performed to determine adaptedness to frequent cutting for fodder production after six cutting cycles
- half-sib families were being evaluated for performance in alley cropping systems --results indicate that most families showed increased biomass after the first cutting, with notable exceptions
- exceptions could justify a recommendation that selection for such responses among families be delayed to later periods in the cutting cycles
- appeared to be concurrence between families in reduced leaf and woody biomass production from the second to the sixth cutting
- large difference among families in production emerges after the sixth cutting, offering the opportunity for selection at that stage

Pattanayak, S., and D.E. Mercer. 1998. Valuing soil conservation benefits of agroforestry: contour hedgerows in the Eastern Visayas, Philippines." *Agricultural Economics*. **18**: 31-46.

- difficulty in verifying that soil conservation is actually one of the primary benefits of agroforestry practices because of non-market aspects of soil value
- this study designed and applied a bio-economic framework to do that -- it tests the framework using data from household surveys in the Philippines, where hedgerow agroforestry was introduced in 1983
- using previously obtained economic studies of soil resources, the authors constructed a weighted soil quality index and regressed it on a variety of farming and site specific variables -- also used a Cobb-Douglas function to relate agricultural profits and soil quality
- results indicate importance of agroforestry intensity, private ownership, land fragmentation, and familiarity with soil conservation as positive covariates of soil quality
- market prices, education, farming experience, farm size, topography, and soil quality shown to be positive covariates of household profits
- authors suggest that since small farmers in the tropics play such a large role in soil and forest resource management, policy makers may want to consider subsidies for the significant up-front costs to help farmers with implementation of agroforestry practices

Pearson, H.A., T.E.Prince Jr., and C.M.Todd, Jr. 1990. "Virginia Pines and Cattle Grazing - An Agroforestry Opportunity." *Southern Journal of Applied Forestry*. **14**:(2) 55-59.

- refutes concept that "Christmas trees and cattle do not mix" by demonstrating an economically viable approach to combining the production of the two
- involved using only one strand of electric fence over the seedling the first year and one strand on each side of the seedlings the second and third years, trees were not damaged and they augmented the cattle income
- careful to note that the reverse approach (adding cattle to an existing Christmas tree farm) is not suggested because of the capital needed for the cattle investment

Pinnners, E. and V. Balasubramanian. 1991. "Use of the iterative diagnosis and design approach in the development of suitable agroforestry systems for a target area." *Agroforestry Systems*. **15**: 183-201.

- found process of iterative diagnosis and design effective in identifying appropriate agroforestry systems for farmers in the Bugesera and Gisaka-Migongo regions of Rwanda
- also found statistical analysis valuable, but not necessary, for comparison between regions or periods
- state that statistical analysis is not necessary because valid conclusions can be drawn by employing farmer participatory approaches
- further discusses appropriate agroforestry practices and farmers' choices for uses of trees

Pratap Narain, R.K., R.K. Singh, N.S. Sindhwal, and P. Joshie. 1998. "Agroforestry for soil and water conservation in the western Himalayan Valley Region of India." *Agroforestry Systems*. **39**: 175-189.

- discusses results of a nine-year study investigating erosion losses
- had test plots planted with *Leucaena leucocephala*, a Eucalyptus hybrid, in block plantations or in alley farming with maize (*Zea mays*), *Chrysopogon fulvus* grass, or turmeric (*Curcuma longa*)
- results showed reduction in runoff and soil erosion by 27% and 45% respectively, by contour cultivation of maize and by 40% to 49% with contour tree rows or *Leucaena* hedges

- blocks plantations of trees almost completely controlled erosion losses and are recommended for steep slopes prone to heavy erosion

Price, C. 1995. "Moderate discount rates and the competitive case for agroforestry." *Agroforestry Systems*. **32:(1)** 53-61.

- states that complementary and supplementary relationships between crop components may make agroforestry more valuable than either pure forestry or pure agriculture
- discusses how agroforestry may be beneficial under purely competitive relationships given certain factors
- simplified model shows significant advantage to agroforestry at moderate rate of discount

Salafsky, N. 1995. "Ecological factors affecting durian production in the forest gardens of West Kalimantan, Indonesia." *Agroforestry Systems*. **32:** 63-79.

- examined beliefs of forest garden owners regarding ecological factors involved in maximizing durian fruit production using GIS-based analysis
- tested several factors including individual tree characteristics, microsite factors, species associations, and overall position of garden
- concluded that respondents generally had accurate perceptions as to how ecological factors affect fruit production
- discussed potential for studying slow-growing agroforestry systems using GIS and statistical control
- stated several caveats to his work, including possibility of bias of farmers in relating age of trees

Scherr, S. 1992. "Not Out of the Woods Yet: Challenges for Economics Research on Agroforestry." *American Journal of Agricultural Economics*. **74(3):**802-808.

- examines three challenges for more effective use of economic analysis in agroforestry development policy and program design: (i) development of a theoretical framework for analyzing the economic role and potentials of agroforestry in farming systems; (ii) development of better methods of incorporating agroforestry into models of household decision making; and (iii) generation of economic data on agroforestry, including development of more effective and efficient methods of data collection
- each challenge discussed at length, covering such topics as 'Incentives for Agroforestry Intensification', 'Modeling Weaknesses', 'Strategies for Data Collection', and several examples
- concludes that more economists should take up the challenges listed here to add to the current knowledge of agroforestry economics
- also stresses how agroforestry programs could benefit from more comprehensive economics research
- **Tables include** "Economic performance and adoption of agroforestry systems in Central America and the Caribbean", and "Indicators of population pressure and forestry supply in Central America and the Caribbean".

Scherr, S. 1999. "The economic context for agroforestry development: evidence from Central America and the Caribbean." *Outlook on Agriculture*. **28(3):** 163-170.

- presents framework for examining the economics of agroforestry in order to include the regional economic context for agroforestry in develop initiatives
- illustrates trends, with findings from a study of agroforestry in Central America and the Caribbean

- economic performance of agroforestry technologies assessed factors such as returns to land, returns to capital, and returns to labor
- discussed regional and local factors that affect economic incentives and adoption -- including tree product markets, local factor markets, and agroforestry productivity
- three important challenges given in implications for planning and policy: (i) policies to promote supply must increasingly consider agroforestry over forestry and plantation over natural forests because of land use intensification; (ii) agroforestry initiatives will need to undertake more market analysis for tree products and provide more sophisticated marketing support because a gradual transition is underway in the orientation of agroforestry and community forestry production from local subsistence to national and international markets; (iii) because land use intensification and extensification are occurring simultaneously in different niches of the farming landscape, agroforestry planners should promote a variety of options that range in intensity for different development pathways that reflect the landscape perspective

Sibbald, A.R., J.H. Griffiths, and D.A. Elston. 1991. "The effects of the presence of widely spaced conifers on under-storey herbage production in the U.K." *Forest Ecology and Management*. **45**: 71-77.

- presents the results of an experiment in which *Picea sitchensis* is thinned and used as an overstorey crop for ryegrass swards (*Lolium perenne*)
- results show that herbage growth was greater below trees that were planted at wider spacings, and the lowest growth was in the areas to the northeast of each tree

Simons, A.J. 1992. "Genetic improvement of non-industrial trees." *Agroforestry Systems*. **18(3)**: 197-212.

- many aspects of non-industrial tree improvement need to be resolved
- differences exist between species used in non-industrial tree improvement programs such as importance, their end-use, target group, and amount of planting material required
- common features exist also: diverse and productive germplasm, knowledge of reproductive biology of the species, ability to test different species/populations accurately, knowledge of ideotype/farmers' needs and criteria, and suitable extension program for release of planting stock, this paper deals with each
- in improvement programs, materials must be properly evaluated in trials, and diverse and productive germplasm must be released
- major cause of the current lack of improvement of non-industrial trees is our deficiency of knowledge of them (such as flowering, method of pollination, etc.)
- **Tables include** "List of characters which might be incorporated in non-industrial tree improvement"

Stewart, J.L., R. Salazar. 1992. "A review of measurement options for multipurpose trees." *Agroforestry Systems*. **19(2)** 173-183.

- states urgent need for standardized method of growth assessment of multipurpose trees
- this paper was prepared specifically to develop internationally recognized standard for assessment methodology
- reviews methods prescribed by different networks for height and diameter measurement and for biomass estimation
- gives researchers a range of options to consider and re-emphasizes the need to define assessment methods clearly and unambiguously

Tacio, H.D. 1993. "Sloping Agricultural Land Technology (SALT): a sustainable agroforestry scheme for the uplands." *Agroforestry Systems*. **22**: 145-152.

- introduces SALT - developed by Mindanao Baptist Rural Life Center in the Philippines to help control soil erosion and increase crop yields
- discusses the background and establishment of SALT
- discusses soil erosion control, economic viability, increased crop productivity and labor comparisons

Unruh, J.D., and P.A.Lefebvre. 1995. "A spatial database approach for estimating areas suitable for agroforestry in sub-Saharan Africa: aggregation and use of agroforestry case studies." *Agroforestry Systems*. **32**: 81-96.

- describes how ICRAF's database of agroforestry case studies can be used with satellite imagery, ancillary information, and a GIS to produce a GIS-based agroforestry research tool in sub-Saharan Africa
- over 170 site-specific case studies of agroforestry were utilized
- addresses need for aggregate-level agroforestry research

Young, A. 1987. "Soil productivity, soil conservation and land evaluation." *Agroforestry Systems*. **5**: 277-291.

- discusses an approach for using agroforestry case studies for research at scales larger than the local site
- Review of ICRAF's main contributions to research related to soils including a 1979 symposium on soils research in agroforestry
- covers the soil productivity aspects of agroforestry as mentioned by ICRAF in 1984 (in the first in the series, 'Science and practice of agroforestry', identifying five land use systems related to agroforestry (shifting cultivation, taungya, plantation agriculture, plantation forestry and multi-cropping), covering their advantages and disadvantages, successes and failures
- lists role of trees in soil production and conservation: maintaining soil organic matter through addition of leaf litter; maintaining nitrogen through fixation by leguminous trees; reduction of leaching losses and make the plant-soil cycle more closed; improving soil physical conditions through maintenance of organic matter and the role of roots; and checking soil erosion by water and wind
- gives basic messages of the review: "by making use of the soil-improving capacity of trees, the potential exists for agroforestry systems to be productive and at the same time sustain soil fertility... the design of agroforestry systems should take account of these features in soil management"
- discusses the potential of agroforestry for erosion control in which a ICRAF review from 1985-1987 is summarized -- includes the potential of agroforestry for control of soil erosion, describes how the major ill effect of erosion is in the lowering of soil fertility
- lists some agroforestry practices that have been successful in erosion control, including barrier hedges, alley cropping, and multistory tree gardens
- second part of review covers the potential of agroforestry for maintenance of soil fertility and restoration of fertility on degraded soils, later lists certain practices that have proven ability of the tree component in augmentation of soil fertility, including alley cropping, multistory tree gardens, biomass transfer, planted tree fallows and trees on pastures
- discusses the SCUAF (Soil Changes Under Agroforestry) model and EDB (Environmental Data Base)
- discusses aspects of, relations, and differences between land evaluation and D&D (diagnosis and design)

Tables include: "environmental problems which agroforestry has a potential to alleviate", "using environmental information on agroforestry", and "processes by which trees maintain or improve soil fertility".