Program Design for Agroforestry Extension in the South-eastern USA

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Before prioritising regional agroforestry training and extension content, it is necessary to discover which practices are common, what benefits are perceived, which barriers prevent use, and how people feel about practices. Agroforestry taps both agriculture and forestry agencies to increase the possible set of educators for landowners and managers. Interdisciplinary activities also present barriers to professionals unfamiliar with some topics or not served by lead partner agencies. To understand motives, barriers and needs involved in agroforestry extension and training activities for professionals, the Center for Subtropical Agroforestry (CSTAF) designed a survey to gauge knowledge, practice and information needs of professionals in Alabama, Florida and Georgia. Landowners in Alabama and Florida received similar survey questionnaires. Initial interviews of a test group with open-ended questions formed the basis for a closed-ended mail survey to all agriculture and natural resource extension agents and county foresters in the subtropical area. Response rates for various professional groups varied between 14% and 43%, and most ranked the potential for use of agroforestry as moderate or high. In all three states, wildlife habitat, water quality and soil conservation were the most important benefits seen by extension professionals. The most important concerns identified were lack of familiarity, lack of demonstrations, no financial incentive, and lack of information about agroforestry. These data provide insights about how to prioritise research and materials development and indicate that agroforestry training can be of expected value to at least half of the regional forestry and extension professionals.

Keywords: baseline survey, benefit and constraint analysis, sustainable agriculture, natural resources management, subtropical

INTRODUCTION

Opportunities for increasing agroforestry adoption are new topics for natural resource professionals in the USA. Common practices, benefits, barriers to use, and how comfortable professionals feel about these practices need to be explored to improve understanding of the motives and needs involved in the expansion of agroforestry. Surveys to gauge existing knowledge, practice and information needs of extension agents, county foresters and landowners or managers in Alabama, Florida and Georgia were conducted in 2001-2002 to help prioritise agroforestry extension training materials and programs for the South-east. Case studies and a practitioner networking are initial steps being undertaken in efforts to showcase benefits of agroforestry practices in the south-eastern states. Future training for forestry and extension professionals, provision of more information for landowners and demonstrations of viable practices will be necessary elements of any successful agroforestry extension program.

Agroforestry combines agricultural and forestry technologies to create more diverse, productive and sustainable land-use systems. Practices focus on satisfying economic, environmental and social objectives held by landowners (Merwin 1997, Rietveld and Francis 2000, Rule *et al*. 2000). Within watersheds and across the landscape, agroforestry helps maintain healthy communities and ecosystems (Matson *et al*. 1997). Diversified practices can be used to help intensify production on private farms and forested land, link habitat or fill gaps in the mosaic of land uses across the region, and serve as tools to supply goods and environmental services from sustainable agriculture (Alavalapati *et al*. 2004, Workman and Allen 2004).

Despite the potential benefits, agroforestry is not widely practiced in the USA. Opportunities for increasing agroforestry adoption and challenges to its expansion have been addressed for North America (Williams *et al.* 1997, AFTA 2000, Garrett *et al*. 2000) and the south-eastern USA (Mercer and Miller 1997, Workman *et al*. 2003). The National Association of Resource Conservation and Development Councils (NARC and DC) recently pointed out the great need for more research and education in agroforestry specifically in the South and South-east (NARC and DC 2000), the regions that contain the largest percentage of farm and private forest ownership in the country (NASS 2001). Clearly, extension activities including development of materials, training and demonstration areas can improve information dissemination mechanisms for this promising approach to sustainable land use (Lassoie and Buck 2000).

For natural resource professionals to be able to conduct the necessary programs for landowners, professionals need enough information to feel confident about the topic and the requisite resource materials to launch workshops and demonstrations. Although the ultimate goal of the extension program of the Center for Subtropical Agroforestry is to change behaviour of landowners, an intermediate goal is to change the behaviour of professionals. Before prioritising agroforestry practices for descriptive publications or training, it was first necessary to determine which practices are most common, what they are called, what benefits are realised from them, which barriers prevent others from using them, and how comfortable professionals feel about these practices. The answers to these questions will allow better use of classic diffusion techniques to equip professionals with relevant tools to change behaviour and promote agroforestry adoption (Ajzen 1985, Rogers 1995,

McKenzie-Mohr and Smith 1999). Recent experience with encouraging extension agents to launch wildland fire programs indicates that agents require background information, current resources, local partners and ready-to-use resources (Monroe *et al*. 2003).

The interdisciplinary nature of agroforestry introduces a possible benefit for extension activities, in that tapping agriculture and forestry agencies increases the possible set of partners to educate landowners. Interdisciplinary activities also bring substantial barriers to professionals who are unfamiliar with the topic and are not served by partner agencies (e.g. the USDA Natural Resources Conservation Service). In some southern states, the state forestry agency provides more information to rural landowners than the extension service with regard to forestry practices, which may make forestry field staff more likely to share information about agroforestry with landowners.

CSTAF conducted a survey to explore extension agent and forestry agency perspectives on agroforestry in the South-east as a first step towards developing program materials. This paper is designed to illustrate how agroforestry might play a larger role in regional extension programs. The text describes how existing knowledge about agroforestry was compiled to indicate which terms and practices may be most acceptable for diffusion, what skills and needs professionals have for conducting agroforestry training, and which topics can be prioritised for inter-institutional collaboration and research activities in the south-eastern U.S. to diversify and intensify farm system management. This multi-institutional initiative is committed to strengthening farmer support services by integrating multi-disciplinary knowledge into professional training programs and establishing a demonstration network to promote greater farmer to farmer communication.

For both professionals and landowners, the lack of familiarity, demonstrations and information were the most noted obstacles to the use of agroforestry practices. There was also a strong belief that markets for products are not well developed (Workman *et al*. 2003). Analyses of responses by landowners in Alabama by Giroux (2004) showed the potential benefits of agroforestry could be broadly grouped into three clusters around finances, the environment, and the aesthetics of their land. These three clusters indicate areas with which landowners are concerned when thinking about agroforestry practices and indicate topic categories professionals will need to address. As indicated by all landowner responses, however, a higher percentage of landowners believed the potential benefits of agroforestry outweighed the obstacles when considering practices to adopt. Descriptions of survey methodology and additional results of the surveys from Alabama, Florida and Georgia are reported by Workman *et al*. (2003) and Giroux (2004), and are not discussed in detail here.

RESEARCH METHOD

To help understand the motives, barriers and needs involved in the expansion of agroforestry in the South-east, the CSTAF extension program designed a survey to gauge existing knowledge, practice and information needs of natural resource professionals in Alabama, Florida and Georgia. An initial survey with open-ended

questions was administered to 21 landowners and extension agents, and formed the basis for a mail survey (Dillman 2000). After a pilot test with extension agents in six counties, and appropriate revisions, 694 questionnaires were mailed in June 2001 to all agriculture and natural resource extension agents and all county foresters in southern Alabama (32 counties), southern Georgia (99 counties) and all of Florida (67 counties), to represent the region served by CSTAF. Counties included signify the subtropical South-east, or approximately the area of the Coastal Plain physiographic region of these states. In many counties, agents in 4-H, livestock, horticulture and nutrition and family sciences also received the survey. To select the reference landowner population, any county with more than 200 people per square kilometre (urban) was eliminated from the sampling frame. The sample size for each county was determined by making the number of farmers selected in the county proportional to the percent of county farmers to total farmers in state. For a desired 25% return rate, the number of questionnaires to mail equalled four times the number needed to represent each selected county's proportion of farmers in the state.

In the survey of natural resource professionals questions addressed: familiarity with agroforestry terms and practices; perceived benefits, constraints, and resources; training materials and information available or preferred; and their knowledge, experience and motivation. To increase response rate, a reminder postcard was sent two weeks after the initial mailing to all non-respondents. Four to six weeks after the initial mailing, a second copy of the survey was mailed to all who had not responded.

Of the 694 participants in the professional survey mailing, 20 were deleted because the person or position was no longer engaged at the location and four were deleted due to faulty (undeliverable) addresses. There were 17 questionnaires returned blank and 278 returned with data for an overall return rate of 43% (278/653). Mean values of question responses were statistically tested with analysis of variance and ranked data were analysed with nonparametric chi-squared tests (using SAS, version 8).

Follow-up phone calls were made to 35 of the professional non-respondents to understand better their lack of response to the questionnaire. Other than the RC and DC coordinators, who had relatively recently responded to another agroforestry survey (NARC and DC 2000), the stated reasons for non-response by this sample group included: 'not applicable to my work' (37%); 'I am too busy already' (34%); 'the topic is not of interest' (20%); and 'someone else in my office completed the same survey' (9%).

SURVEY FINDINGS

The response rate was similar in all states, although proportionally more extension agents returned the survey from Alabama and Florida than Georgia while a higher percentage of foresters from Florida and Georgia responded than Alabama (Table 1). Respondents, in all three states, represented the following primary program responsibilities (some listed in more than one category): Agriculture (31%); Natural Resources (26%); Horticulture (21%), Forestry (15%); Other (15%); Livestock (14%).

Table 1. Percentages of responses by professional grouping

Source group	Alabama		Florida		Georgia	
	%	n	%	n	%	n
	48	42	43	10	30	5
Forestry	29	9	60	36	56	3
RC and DC [a]	0	0	40	2	0	0
Total		51		139		88

[a] RC and DC is the USDA Resource Conservation and Development Council

Agroforestry Practices and their Use

Respondents indicated which agroforestry practices are important in their county on a scale of 1-5 (5 most important); this information tells CSTAF how to prioritise research and publications. Streamside buffer practices are the most important practice (with a mean of 2.3 on the 5 point scale) followed by patio gardens (2.1), forest farming and windbreaks (1.8) and silvopasture (1.5). Alley cropping is the least important (1.2). The only significant differences among the states are that streamside buffers are more important to professionals in Georgia and Alabama than in Florida ($\chi^2 = 17.2$, $p < 0.03$), and patio gardens are more important to those in Florida than in Alabama and Georgia ($\chi^2 = 26.3$, $p < 0.001$).

In response to an open-ended question, 64 respondents noted other practices they would describe as agroforestry: 34% acknowledged wildlife habitat improvement and mentioned combining wildlife plots and hunting leases as possibilities for agroforestry; 30% mentioned some form of grazing, with cattle, goats or other animals in silvopasture settings, and included shade for barns and outbuildings as an additional factor. Others mentioned various compatible practices to diversify citrus groves, complement conservation tillage and weed control, promote bee leases and support agro-ecotourism. In all three states, wildlife habitat, water quality and soil conservation were the most important benefits of agroforestry practices perceived by professionals (Workman *et al*. 2003).

Respondents (n=159) to a question about program materials indicated they use visiting specialists (27%), fact sheets (26%), brochures (23%) and videos (14%) as resources. Of these participants, 9% made an additional note that CDs and slides were useful program resources. Over 20% in each state wrote that more specialist and professional training and more literature are needed.

One-fourth of the respondents reported that they have an agroforestry program while one-third indicated that they are willing to begin one. When asked to rate the potential for agroforestry in their regions overall, 11% ranked it as very high, 25% as high, 30% as moderate, and only 3% ranked it as having no potential (with 10% non-responses). When asked why they believe agroforestry may have a future in their region, one respondent wrote, 'Over time, agroforestry could become very beneficial in this area, but it will take several years to convince people of that. Then people will want to see it done successfully'.

Familiarity with Agroforestry Terms and Concepts
A variety of terms are used in the literature to mean similar things. Any resources provided by CSTAF should use the vocabulary most understood across the region if the familiar terms are accurate. Consequently, the survey assessed familiarity with a variety of similar terms. In the southeast, *windbreak* is more widely recognised than *shelterbelt* (90% vs. 47%); *streamside management zone, riparian forest buffer,* and *waterway buffer* are similarly recognised (70 to 80%), and *forest farming* and *nontimber forest products* were equally acknowledged (63 to 64%). *Patio garden* was more widely used (71%) than *dooryard garden* (44%) to describe deliberate cultivation of trees and other plants grown together near the home. *Silvopasture* was a term recognised by 52% of the professionals. *Intercropping* was a more familiar expression than *alley cropping* (75% vs 36%), but intercropping does not always include use of trees.

   Future training for forestry and extension agents will be a necessary element of a successful agroforestry extension program. This survey helped indicate which topics should be covered during extension training activities. The survey asked respondents to indicate their familiarity with each of six agroforestry concepts and their comfort level for teaching these concepts to others. Table 2 lists the topics in order of familiarity, with 'which trees grow best' the most familiar. The same table indicates the percentage of respondents who felt they had low and high levels of comfort for teaching each topic.

Table 2. Self-rating of how comfortable the respondent would be teaching about the topic

Agroforestry topic	Comfort level[a]			
	Low (%)	Medium (%)	High (%)	No response (%)
Which tree grow best	8	51	28	13
Which trees and/or tree crops are marketable	12	49	26	13
Enhance water quality with trees and shrubs	14	48	24	14
Government incentive programs	24	45	17	14
Designing windbreaks and shelterbelt	24	45	17	14
Managing silvopasture systems	29	43	14	14
What to grow under shade	34	42	11	14
Designing intercropping crops and trees	34	41	11	14

[a] Low rank = 1 or 2; medium = 3; high = 4 or 5 of 5 maximum comfort.

The level of comfort teaching a topic closely parallels their familiarity with it, as might be expected in this audience. Training events can therefore be designed to

help increase professional familiarity and comfort with the listed topics related to agroforestry practices.

   Considering the number of professionals that did not respond to the mailed questionnaire combined with the questionnaire participants, it can be anticipated that the initial agroforestry training program can be of expected value to approximately half of the forestry and extension professionals in the region.

Major Agricultural Products of Florida Landowners

Florida, like other warmer coastal areas of the South-east, has subtropical growing conditions and situations that differ from the majority of farming regions in the USA. Suitability for growing citrus, sugar cane and ornamentals and longer horticulture seasons represent some of the unique agricultural conditions in the state and Coastal Plain. However, the majority of Florida respondents practice livestock production (Figure 1). There are corporate farms and large farms as well as many operations on smaller acreages (Workman *et al.* 2003) as noted in Table 3.

Table 3. Non-parametric comparisons grouped by farm size based on practice of silvopasture (row) and familiarity (column) with the practice

Whether silvopasture is practiced	Small farm (< 8 ha)		Large farm (> 40 ha)	
	χ^2 p>0.0002, n=69		χ2 p>0.3011, n=46	
	Familiar with practice		Familiar with practice	
	No	Yes	No	Yes
No	96%	61%	71%	55%
Yes	4%	39%	29%	45%

Land managers have grazed livestock under tree canopies in the South-east for generations and, with this intergenerational knowledge about running cattle in the woods, most livestock farmers say they have developed more exacting silvopasture practices. Practices were modified either as they learned about fertilisation and improved pasture, or in a more concerted effort to incorporate timber production to increase income, better utilise fertiliser inputs and reduce nutrient loss. Silvopastoral systems are continually being refined, based on experience, and to meet specific objectives, such as meeting criteria to reduce non-point source pollution and income diversification
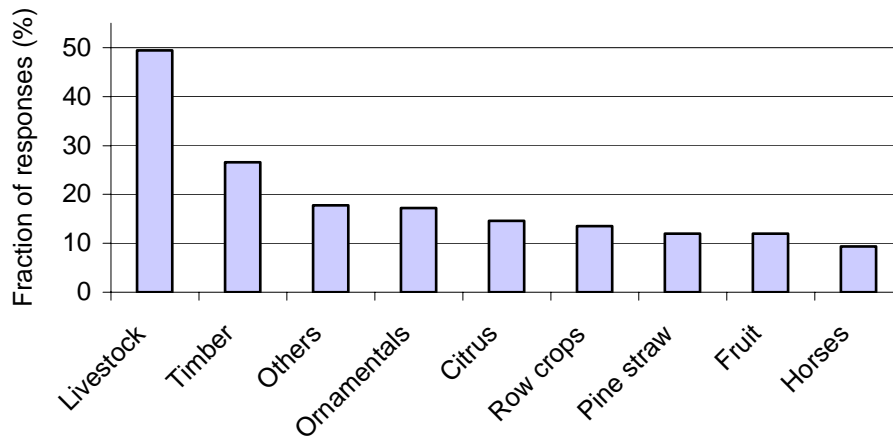
Figure 1. Percentage of agricultural products reported by Florida landowners during 2002 CSTAF agroforestry survey (n=275)

Note: 'Others' includes mainly sugar cane, horticultural crops and hay.

CASE STUDY FOR POTENTIAL OF SILVOPASTURE ADOPTION

Using silvopasture in Florida as a case study, the potential for adoption of the practice by landowners in the state can be examined. Of the 192 Florida landowners responding to the questions about silvopasture the mean number of years of farming experience was 27 years; 70% were male and 30% female; 32% were from 31-50 years old, 50% from 51-70 years and 16% were over 70 years; 91% were white Caucasian; 46% farmed 0-8 ha (0-20 ac), 27% farmed 8-40 ha (21-100 ac) and 27% farmed more than 40 ha; 52% also have windbreaks, 43% have patio gardens, and 36% manage streamside zones. Part-time work on the farm was more common than full-time farming as a livelihood, with 50% of the respondents working 20 hours or less and 27% working 40 hours or more per week on the farm. After reviewing the definitions of practices presented in the questionnaire, 45% of the respondents acknowledged they knew of silvopasture practices while 55% did not.

On smaller acreages (<8ha), 96% of the respondents (44 out of 46) were not familiar with silvopasture and did not have any practice like it on their land, whereas 4% who were not familiar with silvopasture did practice it. For those farmers who were familiar with the term, 61% (14 out of 23) did not practice silvopasture. On larger acreages in Florida more producers were familiar with silvopasture (55% and 45%) and proportionally more (29% and 45%) practiced silvopasture on their land.

The largest percentage of producers was not familiar with the practice and the next largest group was those who know of it but do not practice silvopasture. This points out the opportunity to first inform those unfamiliar with silvopasture about what it is, the potential benefits and constraints of the practice, and then how to implement it. Secondly, if the producer thinks the practice of merit, there is opportunity to help them address whatever barriers to adoption they face.

Given the large number of livestock producers in the region and the potential for combination with another product (timber) valued in available markets, an extension program can learn from these analyses what focus groups to design materials and programs for. Identifying the gap between existing knowledge, available information and landowner practice has helped CSTAF prioritise agroforestry options useful for landowners in the region.

MATERIALS DEVELOPMENT, DEMONSTRATION AND TRAINING

From the landowner surveys, 15 landowners (8% survey respondents) in Florida indicated their willingness to participate in a demonstration network, and in Alabama, 22 landowners (6%) were identified as having possible demonstration sites for training and outreach activities. Currently there are 13 agroforestry demonstration sites in Florida collaborating with CSTAF in the Southeastern Agroforestry Network of Demonstration Sites (SANDS), at locations as indicated in Figure 2. Six of the case studies with landowners, completed to generate greater understanding of agroforestry adoption, are highlighted in the CSTAF Agroforestry Educator Curriculum Guide developed by Strong (2004) for learning and training events. The Curriculum, distributed with a multi-media CD, includes lesson plans with sections on business planning, marketing and funding opportunities, and includes a compilation of reference and handout documents, technical information about practices, and presentations to use with landholder groups. Dozens of extension and training events have been completed with partner groups to date (CSTAF 2005) covering an introduction to agroforestry practices, livestock and/or forage production, goat silvopasture, agroforestry for fruit producers and leading agroforestry activities with youth groups.

The SANDS landowner newsletter and discussion forum were launched in 2004 and landowner field days at the SANDS locations throughout Florida began in the autumn. Field tours are proving successful, allowing participants to see how practitioners implement agroforestry, hear about practices in whatever terms they feel most comfortable describing them, and providing an avenue for networking between and among landowners and professionals.

CSTAF has also developed an online Geographical Information System (GIS) to combine information on soils, vegetation, land use and other factors of interest to land managers in the subtropical regions of North America. The information has been compiled as a demonstration tool to assist landowners, extension agents, county foresters and researchers in development and extension of agroforestry using internet resources, GIS and database management systems. This Decision Support System (DSS) component offers computer-based tools that integrate agroforestry principles, through combining GIS with a tree and shrub database, to access site-specific characteristics, indicate viable practices, and select suitable tree and shrub species. The subtropical tree and shrub database (Ellis *et al*. 2004) contains plant descriptions, and details of ecology and site adaptability of species, management and propagation techniques, and economic and environmental uses of the species. Through this on-line application for tree and shrub selection and evaluation, the DSS is a tool landowners and professionals can use for decision-support during design of

agroforestry plans. The DSS provides and effective component of the extension program design that can allow professionals and landowners access to synthesised knowledge and computer-managed data for their training and extension activities.
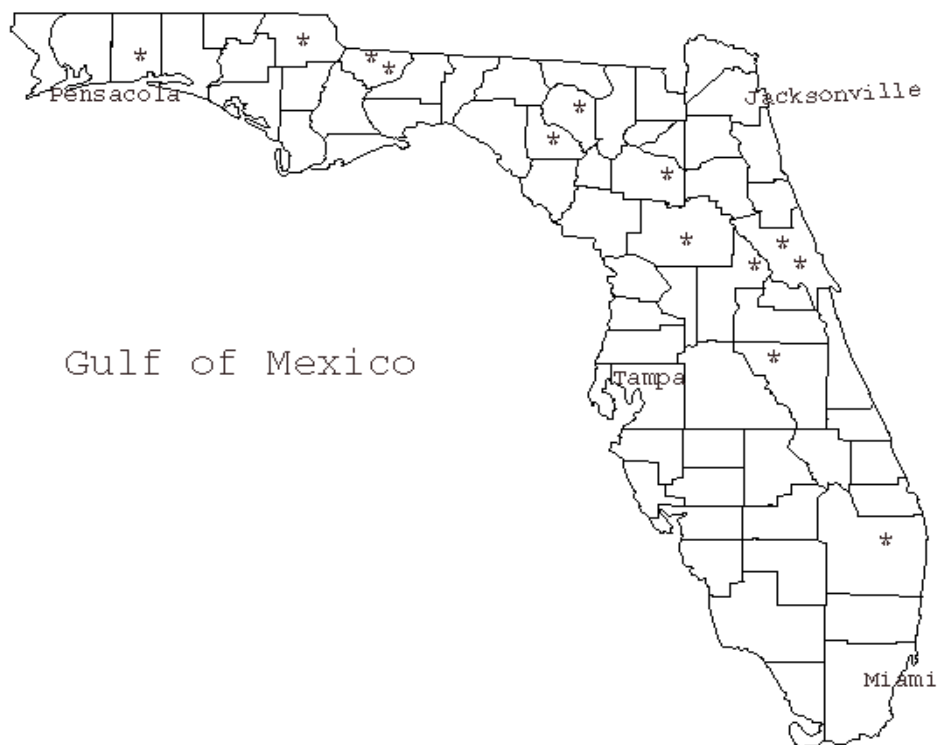

Figure 2. Locations of CSTAF-SANDS agroforestry demonstration sites (* in 2004) in the state of Florida

CONCLUSION

Before a grant-funded program can expect to engage extension and forest resource professionals in delivering a new message to landowners, an extensive assessment should be undertaken to discover what is already in practice, what is perceived as most important and what specific tools will be most helpful. The results of CSTAF surveys reveal the most commonly recognised agroforestry practices among extension agents, county foresters and landowners in the subtropical southeast. These can be encouraged among landowners to enhance benefits perceived as most important, namely wildlife habitat, water quality, soil conservation and income generation. The less-noted practices suffer from lack of available information and understanding, lack of professional awareness, and the low number of demonstrations in this region. CSTAF-sponsored research is working to understand better the practices that can be promoted where conditions are appropriate within landowner priorities. Since there is less familiarity with these practices and fewer

acknowledged examples of their success, information provided during training and demonstrations can help extension and forestry professionals determine where the techniques can be effectively applied. In the hillier areas of Alabama and Georgia, for example, soil conservation is more important than in the flatland of Florida. Where urban encroachment is changing land use, professionals report patio gardens are popular and important.

The survey also made clear that respondents perceive barriers to implementing agroforestry practices, which should be addressed in extension programs. Demonstration areas, publications, decision-support tool development and training programs are underway to help reduce the most important barriers. Financial constraints may be addressed with increased farm diversification or inclusion of products with greater profitability though, in time, producers will be the pivotal force in adoption of viable options when presented with technical information and assistance. Marketing research and assistance for market development or access will take time to develop.

A sizeable minority of professional respondents (41%) in the region already believes that agroforestry has high potential in their counties, but lack the familiarity and resources to launch programs. The extension program plan calls for use of information about technical needs of professionals and landholders, the decision-support system, demonstrations and training events, so as to prioritise, develop and adapt educational materials and client services for regional needs. In this way, CSTAF and partner groups can begin to increase knowledge and skills to improve delivery of agroforestry information across the subtropical South-east.

An effective extension program could overcome many perceived barriers. Coupled with research results that are emerging from trials across the south and other regions, new information will be available to address questions about economic viability of agroforestry practices, emerging product markets, successful species combinations, species interactions and competition, compatibility of the practices within whole farm management, and other aspects of concern to landowners. Extension training will increase awareness of new practices and promote adoption, or adaptation, of known agroforestry technologies in the South-east.

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