Socioeconomic research in agroforestry: progress, prospects, priorities

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Abstract. Fourteen years after the birth of the journal *Agroforestry Systems*, biophysical studies continue to dominate agroforestry research while other important areas have not received the attention they deserve. This paper reviews the progress in one of these under-researched areas, socioeconomics. A quantitative and qualitative analysis of published socioeconomic research papers and a survey of agroforestry socioeconomic researchers are used to evaluate the achievements in agroforestry socioeconomic research over the past 14 years: what are the major advances, gaps in knowledge, and constraints for closing those knowledge gaps? Although agroforestry socioeconomics remains a field in its infancy, both the scope and the quality of socioeconomic research are slowly improving. The recent trend away from literature reviews, qualitative, and purely descriptive quantitative research based on small sample sizes, and toward more rigorous statistical analyses of better and larger data sets is encouraging. Priority areas for future research include theoretical and empirical analyses of agroforestry adoption decisions, improved economic analyses, and policy studies at local, national, and regional levels.

Introduction

Although existing for centuries (maybe millennia) as an array of traditional land-use practices, agroforestry emerged in the late 1970s as a modern, improved land-use system suitable for scientific study, replete with its own international research center and journal. Like the traditional land-use disciplines of agriculture and forestry, agroforestry science spans the disciplinary spectrum from the biological and physical sciences to the social sciences. Understandably, the biophysical sciences have dominated the first two decades of agroforestry research and development because the interest in agroforestry as a land use emerged from observations of the impacts of nonsustainable farming systems on tropical soils and forests (Nair, 1996). Concerns over the inadequacy of socioeconomic research in agroforestry began to grow, however, as improved agroforestry systems were transferred from research institutions to rural development projects.

During the 1980s, agroforestry became an established focus of international rural development efforts. For example, in 1988 and 1989 ICRAF identified 166 agroforestry projects supported by development organizations and government agencies (Müller and Scherr, 1990), and by the early 1990s the US Agency for International Development alone supported 28 agroforestry

projects in 16 countries (Mercer, 1993). Despite some impressive scientific and technological advances, agroforestry rural development efforts were frequently unsuccessful (Nair, 1996). Although agroforestry projects failed for a number of different reasons, one common factor was the inadequate attention given to socioeconomics in the development of systems and projects. As Current et al. (1995) point out, many projects failed because producing benefits for farmers was rarely an important objective of agroforestry. To remedy this, many agroforestry institutions are now calling for increased socioeconomic research. In this paper, we evaluate the current status of socioeconomic research in agroforestry to answer three basic questions: what has been done, what are the gaps in our knowledge, and what are the priorities for future research? To answer these questions, we quantitatively and qualitatively analyze socioeconomic papers published in *Agroforestry Systems* during the period from 1982 to 1996 and present the results of a survey of agroforestry socioeconomic researchers.

What has been done? A review of socioeconomic articles in *Agroforestry Systems*

In order to assess the current status of agroforestry socioeconomic research, we reviewed all papers published in *Agroforestry Systems* since its inception in 1982. Since socioeconomic research results are published in a variety of other journals, books, conference proceedings, and research reports, restricting our analysis to *Agroforestry Systems* may overlook many important contributions to the field. Nevertheless, we felt that as the major outlet for agroforestry research (of all disciplines), *Agroforestry Systems* should provide a reasonable overview of the relative emphasis and progress made in the many disciplines that comprise socioeconomics (including all disciplines in the social sciences, but specifically, sociology, economics, anthropology, human ecology, geography, and public policy studies). Therefore, using *Agroforestry Systems* as a sample of current and past agroforestry research efforts, we examine what has been accomplished, where the socioeconomic side of agroforestry is headed, what methodologies are being employed, and what major questions are being addressed.

Methods

An initial screening of all issues of *Agroforestry Systems* was carried out to identify articles that had a substantial focus in one of the socioeconomic disciplines (i.e., sociology, economics, anthropology, human ecology, geography, or public policy). Abstracts of all articles published between 1982 and 1996 were examined, and those that mentioned any type of social, cultural, or economic content were selected for further analysis. These articles were then read in detail to ascertain the extent of socioeconomic content. Many of these only briefly mentioned socioeconomic information, such as family size,

population density, and village size, as background information for biophysical studies, so were deleted from the set of socioeconomic papers. This process resulted in the identification of 113 papers with a primary focus on socioeconomics. To facilitate analysis, the articles were divided into three groups, based on five-year time periods: 1982-86, 1987-9 l and 1992-96. The selected articles were then re-read and classified into categories, according to the following criteria:

- discipline;
- type of research
- data collection method(s);
- type of analytical method(s);
- type of agroforestry system(s); and
- geographic and eco-region of study site(s).

Results

A count of articles published in *Agroforestry Systems* between 1982 and 1996 (and for each five-year period) is presented in Table 1.' Out of a total of 5 17 articles published, 113 (22%) were classified as predominately socioeconomic. The percentage of socioeconomic papers has remained fairly constant: 24% for 1982-86, 20% for 1987-91, and 23% for 1992-96. This suggests that despite recent efforts to increase socioeconomic research, the dominance of the biophysical sciences in *Agroforestry Systems* has remained virtually unchanged over the past 14 years.

Table 2 presents the relative numbers and percentages of socioeconomic articles by primary disciplinary focus. Economics, whether theoretical or applied, has consistently made up the largest single category of socioeconomic papers, representing 50% (11 articles) of the total in 1982-86, 59% (25 articles) in 1987-91, and 49% (24 articles) in 1992-96. The general category of Project Development follows in second place, as the focus of about one-fifth of all socioeconomic papers (9% in 1982-86; 29% in 1987-91; 16% in 1992-96). The Project Development category includes all papers that examine agroforestry projects in general terms without any specific academic focus. The majority of these are qualitative evaluations and descriptions of the design and implementation of projects and extension methodologies.

Table I. Number and percentage of socioeconomic articles in *Agroforestry Systems* from 1982 to 1996.

Agroforestry Systems articles	*1982–86*	*1987–91*	*1992–96*	Total *1982–96*
Number of socioeconomic articles	*22*	*42*	*49*	*113*
Total number of articles	*92*	*215*	*210*	517
Percentage of socioeconomic articles	*2 4*	*20*	*23*	*22*

Table 2. Number and percentage of socioeconomic articles in *Agroforestry Systems*, by discipline.

Discipline	1982-86		1987-91		1992–96		Total 1982–1996	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Project development	4	18	12	29	8	16	24	21
Sociology	3	14	4	9	5	10	12	II
Human ecology/ Anthropology/Geography	4	18	1	2	4	8	9	8
Economics	II	50	25	59	24	49	60	53
Policy	0	0	0	0	8	16	8	7

Only 12 sociology papers (11% of all socioeconomic papers) were published during the 14 years. The nine papers examining cultural aspects of agroforestry systems (counted in the combined discipline of human ecology, human geography and anthropology) represent only 8% of the total. There are several possible explanations for this paucity of sociology and anthropology papers in *Agroforestry Systems.* First, as one reviewer noted, sociologists and anthropologists may be publishing much of their agroforestry research in more disciplinary-focused, peer-reviewed journals due to academic pressures. However, these academic pressures are no different for economists or bio-physical scientists. Second, perhaps sociological and anthropological studies are being disproportionately published in the non-peer-reviewed, grey literature produced by donor agencies and non-governmental organizations (NGOs). For example, one anonymous reviewer reported that the Food and Agriculture Organization, the Overseas Development Institute, and Intermediate Technology have been publishing sociology and anthropology case studies for at least five years. However, much biological and economic research is also initially published in this type of literature prior to publication in peer-reviewed journals. There is no a priori reason to believe that sociology and anthropology studies are disproportionately represented in the grey literature. Nevertheless, *Agroforestry Systems* may need to make a greater effort to convince sociologists and anthropologists to publish in peer-reviewed fora, such as *Agroforestry Systems,* that reach the broader agroforestry community. Third, there may indeed be significantly fewer sociological and anthropological studies of agroforestry, which would suggest a considerable need for increased sociological and cultural research.

Finally, it is noteworthy that no papers with policy as the primary focus were published until 1992. Prior to 1992 there were only four papers published in which policy analysis was identified as even a secondary disciplinary focus. It is encouraging, however, that the number of policy papers has increased dramatically in the past few years.

Type of research and analysis

The percentages of papers by type of research and analysis are presented in Tables 3 and 4, respectively. It appears that agroforestry may be entering a third generation of socioeconomic research. In the first generation (1982–86), there was an emphasis on general theoretical and review papers of agroforestry and the problems that socioeconomics might address. The majority of these were based on literature reviews and qualitative analyses. In the second generation of papers, we see an increase in empirical, quantitative papers. The importance of such empirical studies increased over time, representing 45% of the papers in 1982-86, 58% in 1986-92, and 70% in 1992-96. Most of these empirical studies, however, rely primarily on qualitative and simplistic quantitative methods, and cost-benefit analysis. During 1987-9 1 and 1992-96, there was a disconcerting increase in papers relying on qualitative analyses and a decrease in simulation and modeling papers. In recent years, however, a third generation of research appears to be emerging, research that is primarily empirical but that utilizes increasingly sophisticated techniques based on multiple regression analyses. These studies increased from 0% of all studies

Table 3. Type of research of socioeconomic papers in *Agroforestry Systems.*

Type of research	Percent of all socioeconomic articles			
	1982-86	1987–91	1992-96	Total 1982–96
Theoretical/modeling	9	7	6	7
Empirical/descriptive	27	37	39	3.5
Empirical/analytical	18	21	31	2.5
Literature review	32	21	16	21
Simulation	5	12	6	8
Case study	9	9	2	4

Table 4. Type of analysis used in socioeconomic articles published in *Agroforestry Systems.*

Type of analysis	Percent of All socioeconomic articles			
	1982–86	1987-91	1992-96	Total 1982-96
Qualitative	54	33	44	41
Quantitative/descriptive	14	19	14	16
Quantitative/means comparison	5	5	6	5
Quantitative/cost-benefit	22	26	24	25
Quantitative/regression			6	3
Quantitative/Simulation	—	10	2	4
Quantitative/optimization	—	2	4	3
Quantitative/modeling	5	5		3

in 1991 to 6% from 1992 through 1996. This trend must continue for agro-forestry socioeconomic research to have significant impact.

*Types **of** surveys and sample sizes*
As indicated in Table 5, the number of papers based strictly on literature declined sharply between 1982 and 1996, from 54% to 18% of all socio-economic papers. The number of papers using formal survey techniques (based on scientific sampling methodologies and structured survey instruments to collect primary data suitable for statistical analysis) increased significantly over the past 15 years, from 14% in 1982-86 to 38% in 1992-96 (see Table 5). The percentage of studies using informal survey techniques (based on non-scientific sampling and unstructured/conversational approaches to collect data suitable for qualitative analysis), however, remained much the same and even increased recently (1982-86: 14%; 1987-91: 12%; 1992-96: 16%).

As shown in Table 6, sample sizes used in surveys ranged from an average of 39 (median = 36) in 1982-86 to 101 (median = 95) in 1987-91 and 124 (median = 66) in 1992-96. Overall, 42% of all surveys were based on 50 or fewer observations, and 63% were based on 100 or fewer observations. These small sample sizes suggest that conclusions drawn from past empirical work in socioeconomics are rarely generalizable, substantially reducing their reliability and impact. As one reviewer noted, there are certain types of research for which small sample sizes are appropriate, for example, participatory, qualitative research which is not necessarily seeking global or widely gener-alized outcomes. However, the agroforestry literature is dominated by studies that have little significance beyond the individual study, and from which little can be concluded for other sites or situations. If agroforestry socioeconomic research is to progress, it must move toward research intended to produce more generalizable results, and these usually require larger sample sizes. Thus, the recent trend toward larger sample sizes is encouraging.

Table 5. Type of data collection methods used in socioeconomic articles in *Agroforestry Systems.*

Data collection method	Percent of all socioeconomic articles			
	1982–86	1987–91	1992–96	Total 1982–96
Literature	54	28	18	29
Formal survey"	14	29	38	29
Informal survey[h]	14	12	16	14
Secondary sources	9	21	14	16
Field Plots'	9	10	14	12

[a] Formal surveys arc defined as surveys using scientific sampling methodologies and structured survey instruments to collect data suitable for quantitative statistical analysis.
[h] Informal surveys are defined as surveys using non-scientific sampling methods and unstruc-tured, conversational approaches to collect data suitable for qualitative analysis.
[ι] Field plots refers to data, collected from research stations' or farmers fields, usually used for inputs and outputs for cost-benefit analysis.

Table 6. Number of socioeconomic articles in *Agroforestry Systems* based on different survey sample sizes.

Survey sample size	1982–86	1987-91	1992–96	Total 1982–96
≤ 25	2	2	4	8
26-50	2	2	6	10
51–100	1	3	5	9
101–200		2	3	5
201-300		3	1	4
301-400	—	—	5	5
≥ 401		2		2
N =	5	14	24	43
Mean	39	101	124	139
Median	36	95	66	72

Geographic and eco-regions

Table 7 presents the percentage of papers focusing on various geographic and eco-regions. With the exception of the first five-year period (1982–86), in which papers dealing with unspecified regions made up 26% of the total, socioeconomic papers have concentrated on Africa, Southeast Asia, and South Asia. Latin American papers are under-represented, declining from 14% in 1982-86 to 10% in the last two five-year periods (1987-91 and 1992-96). The paucity of Latin American papers may be due to language barriers or preferences for publishing in regional journals, or alternatively to a real decline in agroforestry socioeconomic research in Latin America relative to Africa and Asia.

Table 7. Eco- and geographic regions of socioeconomic studies in *Agroforestry Systems.*

	Percent of all socioeconomic papers			
	1982–86	1987–91	1992-96	Total 1982-96
Ecoregion:				
Temperate	5	7	13	9
Humid tropics	45	33	24	31
Subhumid tropics	5	17	25	18
Semiarid	9	12	15	12
Tropical highlands		5	10	6
Unspecified	36	26	13	24
Geographic region:				
Africa	22	14	38	25
Southeast Asia	23	21	10	16
South Asia	5	26	20	20
Latin America	14	10	10	II
Temperate	5	7	12	9
Various/unspecified	31	22	10	19

As expected, the humid tropics were the most important ecoregion represented in the period 1982-86, with 45% of the total, while papers dealing with unspecified ecoregions made up 36%. However, both of these regional categories gradually decreased in importance as temperate, tropical highland, semiarid and subhumid ecoregions were increasingly represented. During the last time period (1992–96), the subhumid tropics were the most studied (25%), followed by the humid tropics (24%), semiarid regions (1 5%), temperate areas (13%) and tropical highlands (10%). Although the percentage of papers from temperate regions has increased over the past 1.5 years (from 5% in 1982-86 to 13% in 1992–96), agroforestry socioeconomics continues to focus on less-developed, tropical regions.

Type of agroforestry system
The period 1982-86 is characterized by a substantial number of theoretical articles that do not refer to any specific agroforestry system, as can be seen in Table 8. However, the 'No specified system' category decreases gradually over time from 24% of the articles in 1982-86 to only 14% in 1992-96. The remaining papers deal with a wide range of agroforestry systems, a demonstration of the broad universe of interest to researchers. Particular emphasis occurs, however, in the categories 'trees in fields or field boundaries (bunds)' which constitutes 19% of the 1987-93 papers, and 'alley cropping,' which accounts for 14% of the papers in 1992-96. In both of these cases, the relative importance can be correlated with a regional emphasis for each of these periods. In 1987–91, the most important region represented in the socioeconomic papers was South Asia (26%), where (particularly in India) research

Table 8. Type of agroforestry system examined in *Agroforestry Systems* socioeconomics papers.

Type of agroforestry system	Percent of all socioeconomic articles			
	1982–86	1987–91	1992–96	Total 1982–96
No specified system	24	17	14	17
Taungya	8	7	2	5
Alley cropping	8	4	14	9
Silvopastoral	4	11	12	10
Multipurpose trees	8	4	12	Y
Woodlots	4	7	7	6
Swidden agriculture	12	7	3	6
Mixed perennials	4	4	7	5
Trees in fields/bunds		19	10	12
Non-timber forest products	8			3
Small farm (unspecified)	12		2	3
Homegarden	4	9	7	
Erosion control	4	ι		2
Other		9	2	4
Various agroforestry systems			5	2

emphasized the planting of eucalyptus in farmers' fields. Likewise, in articles from 1992-96, the most important region was Africa (38%), where alley cropping received considerable attention on research stations and also in on-farm trials.

What are the major gaps, advances, and priorities? A survey of socioeconomic researchers

A survey of agroforestry socioeconomics researchers was performed in August 1996. The primary objective of the survey was to obtain a cross-section of opinion on the status of and priorities for socioeconomic research. Agroforestry researchers around the world were asked their opinions on the advances and gaps in agroforestry socioeconomic knowledge, constraints to closing those gaps, and the most important priorities for future socioeconomic research. Methods and results are presented in this section.

Methods

Developing a sample frame for a survey of agroforestry socioeconomics researchers proved difficult. The authors contacted several agroforestry institutions (e.g., ICRAF, *Agroforestry Systems,* USDA National Agroforestry Center, Association for Temperate Agroforestry) in an attempt to develop a mailing list of agroforestry socioeconomists. Unfortunately, not a single agroforestry institution was able to provide a listing of agroforestry scientists by discipline. Finally, a sample frame was developed using lead authors of recent (since 1990) agroforestry socioeconomic publications and lists of presenters at recent agroforestry conferences and symposia. The final sample frame consisted of 93 scientists (from 23 countries) who had been involved in agroforestry socioeconomics research during the past five years. Forty-seven percent were current residents of the United States or Canada, while fifty-three percent were current residents of other countries.

Diskettes containing a computer-assisted questionnaire, developed with Sawtooth Software's Ci3 software package*, were mailed to each scientist. Respondents were asked to provide background information on their education, current employment, agroforestry experience, and to list the following:

- The three most important advances in agroforestry socioeconomics during the past 20 years;
- The three most crucial gaps in agroforestry socioeconomic knowledge;
- The three most important constraints to closing the gaps in agroforestry socioeconomic knowledge; and
- The three highest priorities for future agroforestry socioeconomic research.

Results

Of the 93 surveys mailed, 33 usable surveys (35%) were returned. The relatively low response rate can be attributed to the international nature of the survey and the fact that limited funds did not allow subsequent re-mailings to non-respondents. The respondents' current residences reflected the initial sample frame, with 45% of responses from scientists in the US and Canada, 15% from Europe, and the remaining 40% from Africa, Asia, Latin America, Australia, and New Zealand.

Characteristics of the respondents are presented in Table 9. Seventy-eight percent are PhDs, and seventy percent have more than five years of experience in agroforestry research (12% have more than 15 years of agroforestry research experience). Similar to the disciplinary focus of *Agroforestry Systems* articles, the majority of respondents (54%) were economists, followed by

Table 9. Characteristics of survey respondents.

Nighest education:
PhD 78%, Masters 19%, Bachelors 3%

Agroforestry research experience:

More than 15 years:	*12%*	5-- 10 years:	*40%*
IO- 15 years:	18%	Less than 5 years:	30%

Disciplines:

Economics:	*54%*	Sociology:	3%
Forestry:	18%	Agriculture:	3%
Geography:	*9%*	Other:	*12%*

Institutional affiliation:

Universities:	67%
Int. research org.:	18%
Other:	15%

Number of agroforestry socioeconomic publications:

All publications:	Total = 218, Mean = 6.36, Median = 5, Range I-40
Peer-Reviewed:	Total = 84, Mean = 2.5, Median = 2, Range O-20

Number of agroforestry projects:

Total (all respondents):	210
Mean:	6.36
Median:	4
Range:	1-25

Ecoregions of agroforestry projects:

	Past	Current
Temperate-Mediterranean:	18%	27%
Tropical:	62%	57%
Arid/Semiarid:	*19%*	*10%*

Disciplinary focus of past projects:

Economics:	30%	Anthropology:	10%
Policy:	18%	Biophysical:	9%
Sociology:	15%	Geography:	3%
Extension:	14%		

foresters (18%), other (12%) and geographers (9%). Sixty-seven percent were employed by universities, while 18% worked for international research organizations such as ICRAF. Respondents had published a total of over 200 agroforestry publications (mean = 6.36, median = 5) of which 84 were in peer-reviewed journals (mean = 2.5, median = 2). Respondents identified 210 previous agroforestry projects with which they had been involved, 62% of which were in the tropics, 18% in temperate or Mediterranean regions, and 19% in arid or semiarid areas. Although the majority of respondents were economists, the disciplinary foci of their past projects were more evenly distributed among the major socioeconomic disciplines.

Major advances

The most important advances in agroforestry socioeconomics identified by the survey respondents are presented in Table 10. Economic analysis methods (cost-benefit, optimization, mathematical programming) were the most frequently cited advance. They were cited 11 times and accounted for 21% of all responses. Of these, cost-benefit analysis (cited seven times) predominated while optimization tools such as mathematical programming were cited four times. Although no anthropologist and only one sociologist chose to respond to the survey, understanding traditional knowledge and gender issues, and incorporating them in agroforestry research and development were the second and third most common advances identified. Understanding factors influencing adoption behavior, identifying impacts of land- and tree-tenure, developing methods for integrating socioeconomics and biophysical approaches, and participatory research techniques were the other frequently mentioned advances in agroforestry socioeconomic knowledge.

Table **10.** Most important advances in agroforestry socioeconomics research.

Advances	Number of listings*	Percentage
Economic analysis (cost-benefit, optimization, mathematical programming)	11	21
Traditional knowledge	7	13
Gender issues	6	11
Adoption behavior	6	11
Systems approaches to research (integrating socioeconomics with biophysical)	5	9
Participatory research	5	9
Land- and tree-tenure and tree tenure issues	4	8
Understanding bioeconomic relationships	2	4
Intra-household time allocation	2	4
Market impacts	2	4
Credit issues		2
Multipurpose trees		2
Role in rural development		2

* Based on survey responses.

Knowledge gaps

As illustrated in Table 11, many of the most crucial gaps in agroforestry socioeconomic knowledge are identical to the major advances cited by survey respondents. For example, understanding factors influencing adoption behavior was the most frequently listed gap in socioeconomic knowledge (19% of all listings), while improving economic models and tools (principally cost-benefit analysis) placed a close second with 14%. Participatory research methods, land- and tree-tenure, and market analyses also appear on both the 'advances' and 'gaps' lists. Furthermore, several of the other gaps listed are crucial areas for improving cost-benefit analyses. These include valuation of non-market goods and services produced by agroforestry systems, risk and uncertainty, and market analyses.

The constraints to closing the gaps in socioeconomic knowledge which were listed by survey respondents are shown in Table 12. The four most important constraints are closely related to one another. The lack of strong agroforestry institutions and the short-sighted focus and priorities of governments and donor organizations result in limited funding opportunities for agroforestry socioeconomic research. Inadequate funding, the narrow disciplinary focus of researchers and institutions, and the lack of institutional support for interdisciplinary studies produce difficulties in attracting socioeconomics professionals and students to agroforestry research, resulting in the human resources constraint. This suggests that increasing and improving agroforestry socioeconomic research will require a concerted and multifaceted effort that will be neither simple nor easy.

Table II. Most crucial gaps in agroforestry socioeconomic knowledge.

Knowledge gaps	Number of listings*	Percentage
Adoption (household decision-making)	13	19
Better economic models and analytical methods	10	14
Impacts on households (welfare and equity)	7	10
Macro-economic and policy studies	7	10
Non-market valuation	6	9
Sustainability (long-term studies and impacts)	6	9
Land- and tree-tenure	4	6
Improved extension strategies and participatory research	3	4
Risk and uncertainty	3	4
Comparative, cross-site studies	3	4
Integrating anthropology and cultural studies with economics	2	3
Better data sets	2	3
Market analyses	2	3
Incorporating GIS with socioeconomic research	1	1

* Based on survey responses

Table 12. Constraints to closing gaps in agroforestry socioeconomic knowledge.

Constraints	Number of listings*	Percentage
Funding	13	27
Human resources	8	17
Narrow disciplinary focus of researchers and institutions	8	17
Priorities and short-term focus of government institutions and aid agencies	8	10
Lack of agroforestry institutions	7	8
Complexity of agroforestry	2	4
Lack of appropriate methodologies	2	4
Lack of institutional support for interdisciplinary studies	2	4
Systems for delivering research results	2	4
Inadequate biophysical data for socioeconomic studies		2
Fragmentation and duplication of research efforts		2

* Based on survey responses.

Priorities for future socioeconomic research

The most important future research priorities reported by the survey respondents are listed in Table 13. These follow closely, but are not identical to, the crucial gaps identified in Table 11. Understanding adoption behavior again leads the list (19% of all listings), followed by improving economic models and methods (11%), analyzing impacts on farm households (11%), and integrating farm-level research with policy and regional analyses (10%). The most important priorities tend to be interrelated, for example, understanding and predicting adoption behavior and analyzing impacts on farm households. Furthermore, the most commonly used tool for impact assessment is cost-benefit analysis. Some of the major areas in need of research for improving

Table 13. Priorities for future socioeconomic research.

Research priority	Number of listings*	Percentage
Adoption behavior	10	19
Impacts on farm households	6	11
Improved cost-benefit and profitability analysis	6	11
Integrate farm, policy, and regional level research	5	10
Non-market valuation	4	8
Participatory research methods	4	8
Land- and tree-tenure issues	3	6
Risk and uncertainty	3	6
Criteria for sustainability	3	6
Institutionalize agroforestry	2	4
Improve data (bioeconomic, culturally informed)	2	4
Market research	2	4
Gender research	2	4

* Based on survey responses.

agroforestry cost-benefit analysis include methods for measuring and incorporating non-market values, evaluation of risk and uncertainty, improvement of bioeconomic data sets, and increased understanding of the interactions between food, wood, labor, and capital markets in semi-subsistence rural economies.

Discussion

As emphasized in the survey of agroforestry socioeconomics scientists (Tables 10–13), the areas in which the most important advances have been made remain the priority areas for future research. This suggests that agroforestry socioeconomics remains a field in its infancy. One might be tempted to speculate that the greatest advance to date is the growing recognition (among non-socioeconomists) of the need for increased socioeconomic research. This research should focus on three principal areas: (1) understanding the agro-forestry adoption decision-making process, (2) improving economic analyses of agroforestry systems, and (3) analyzing the impacts of alternative policies (at local, regional and national levels) on the potential of agroforestry-based, rural development initiatives. Each will be briefly discussed below.

As Sanchez (1995) aptly points out, developing and empirically testing models that accurately predict farm household land-use decisions is as essential to achieving success in agroforestry as developing models that accurately predict how trees and crops will interact. Unfortunately, most of the socioeconomic modeling efforts to date have not adequately incorporated many basic and distinguishing features of agroforestry systems. These features include the multiple output nature of agroforestry, the intertemporal and spatial variability in production of the multiple outputs, the multiple economic roles of trees on farms, the impacts of off-farm and extra-household opportunities on agroforestry decisions, and the social and cultural context of farm household decision-making. Both theoretical and empirical models of decision-making should focus on the multi-attribute nature of land-use systems, the ways in which farmers value different attributes of land use, and how they make trade-offs in choosing between land-use systems with varying attribute combinations. Under-studied attributes include production of non-market goods and services; aesthetics; long-term benefits such as soil conservation; risk and uncertainty; the role of markets; gender issues and impacts on intra-household allocation of labor; and religious and other social and cultural attributes.

Recent reviews of economic evaluations of agroforestry projects (e.g., Swinkels and Scherr, 1991; Scherr, 1995) confirm our analysis that improving agroforestry cost-benefit analysis remains an area that requires significant additional research effort. The majority of previous cost-benefit studies consist of ex-ante financial analyses lacking sufficient detail and geographic scope to provide reliable and robust conclusions on the relative profitability of

agroforestry. Rarely have they reflected farmers' perspectives or used empir-
ical field data. Even from a planner's or government's perspective, most
previous studies are deficient, since the vast majority ignore environmental
and other non-market benefits that are often the primary motivations for most
agroforestry projects. Furthermore, a number of cost-benefit analyses report
unbelievably high rates of return to agroforestry investments. If agroforestry
systems truly produced internal rates of return of 30% to 50% (as have been
reported in several studies), farmers (and other investors) would be flocking
to agroforestry. Extension and incentive programs would be unnecessary. More
likely, analysts are either relying on inaccurate data that exaggerate the benefits
or overlooking some of the costs associated with agroforestry.

Recent efforts are beginning to improve agroforestry cost-benefit analysis,
as evidenced by the collection of studies presented in Sullivan et al. (1992)
and Current et al. (1995). Nevertheless, the majority of these improved studies
still rely on inadequate sample sizes and ignore non-market benefits and
services of agroforestry systems. Critical research needs for improving agro-
forestry cost-benefit and impact analyses include incorporating risk and uncer-
tainty, estimating and incorporating non-market goods and services produced
by agroforestry systems, multi-input and output production function analysis,
and linking economic analyses to primary, field and household survey data.
Now that many agroforestry projects have 10- to 15-year histories, it is time
to move from over-reliance on ex-ante analyses to thorough and rigorous ex-
post cost-benefit analyses based on extensive farmer surveys. These analyses
should also include evaluations of the inter-household and inter-generational
equity impacts of agroforestry projects.

A wide variety of policies directly and indirectly influence the ability of
agroforestry systems and projects to deliver benefits to individual farmers and
the larger society. These include, but are not limited to, policies affecting labor,
capital and goods markets, land- and tree-tenure policies, and energy policies.
Understanding how this morass of interacting public policies influences the
agroforestry decisions of small, semi-subsistent farmers in rural agricultural
communities with varying social and cultural environs remains a daunting
challenge. Yet, without this understanding we will mostly be shooting in the
dark in designing agroforestry systems and implementing agroforestry
projects.

Conclusions

Our analysis of the first 14 years of articles in *Agroforestry Systems* suggests
that both the scope and the quality of socioeconomic research is slowly
improving. Although the absolute numbers of socioeconomics research papers
have increased significantly, the percentage of socioeconomic papers relative
to the total number of papers in *Agroforestry Systems* has remained virtually
unchanged since 1982. This suggests either that recent efforts to encourage

more socioeconomic research have yet to bear fruit or that socioeconomics researchers are publishing much of their agroforestry research elsewhere. The recent trend away from literature reviews, qualitative, and purely descriptive quantitative research methods based on small sample sizes, and toward more rigorous, statistical analyses of better and larger data sets is encouraging.

Economics has consistently dominated agroforestry socioeconomics research. This may result from the influences of donor and funding agencies that emphasize cost-benefit and profitability analyses for project decision-making. Unfortunately, most of the economic analyses have applied rather simplistic analytical techniques to questionable data. We need to encourage the move toward more rigorous analyses that we have witnessed during the past couple of years.

Despite the considerable efforts that have been expended toward promoting and implementing participatory research methods, the dearth of sociology and anthropology based agroforestry research (as reflected in *Agroforestry Systems*) is disturbing. Even if sociologists and anthropologists are publishing the bulk of their work in their own disciplinary journals or in the grey literature produced by donor agencies and NGOs, this is still problematic since it is doubtful that agroforestry planners (particularly in less-developed countries) have access to or regularly review those publications. It is difficult to envision effective participatory research or agroforestry project and policy initiatives without substantial social and cultural understanding of how individuals and communities relate to, make, and react to changes associated with replacing current agricultural systems with modern agroforestry systems. Combined with inadequate economic analyses, the paucity of social, cultural, and policy research is likely responsible for much of the ineffectiveness associated with past agroforestry development projects.

Notes

A list of all the identified socioeconomics articles may be obtained by sending an e-mail request to *emercer@rtpmail.emapfhm.gov*.

[2] The Ci3 System is a software package with capabilities for composing computer-assisted interviews, administering interviews in the field, and doing simple data analysis for facilitating computer-assisted interviewing.

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