TREES ON ORGANIC FARMS

by

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A paper submitted to the Graduate Faculty of

North Carolina State University

in partial fulfillment with the

requirements for the degree of:

Master of Natural Resources

Natural Resources

2001

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Acknowledgements

This project would not have been possible without the invaluable participation of several talented and experienced individuals. I would like to express my gratitude to Dr. Erin Sills for her assistance in the development and completion of this project, as well as her guidance through my studies at North Carolina State University. I would also like to acknowledge Dr. Pete Bromley for his words of encouragement and constructive criticism. Many thanks must also go to Dr. Ben Bergmann for all his generosity and expertise each step of the way. My experience with this committee has fostered my educational and personal development.

The data for this project could not have been collected without the voluntary participation of all the organic farmers from the ATTRA website and Carrboro Farmer's Market. I would like to thank each and every one of them for taking time from their busy and demanding lives to fill out the survey. It is my ambition to join the ranks of these honorable farmers and to continue research that will someday result in better land stewardship.

Dr. Tom Johnson's guidance in the design and statistical analysis of the survey and it's results was also extremely helpful. A sincere thank you goes out to him for his professionalism and expertise.

Finally I would like to thank my mom and dad for all their patience, confidence, encouragement, and assistance during my graduate studies and more specifically this project. Graduate school is difficult not only for the student, but for those who live with them.

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Abstract

According to the literature, tree management practices can contribute not only to the increased diversity and stability of a farm's ecology, but also to the enhancement of the farm's financial well being both directly and indirectly (Burley, 1987; Nair, 1993). The more farmers know about incorporating trees into their farmscapes, the more likely the farmers are to have a better understanding of all the benefits incurred from such practices. Although trees are commonly found on farms, they are not commonly integrated into the farming system in the United States (Lassoie & Buck, 2000). The purpose of this study is to determine whether or not organic farmers perceive or gain all the potential benefits of trees in their farmscapes.

Data were collected via a nationwide survey of organic farmers. Specifically, the survey elicited information on the current use, knowledge base and attitudes among organic farmers in the United States regarding tree components on their farms. This survey also tested the assumption that all organic farms have at least one tree component on their property.

Results of the survey of 51 respondents suggest that: (1) these farmers perceive more benefits than drawbacks from tree components on their farms, (2) all farmers have at least one tree component on their land, (3) aesthetics is listed most often as a benefit, (4) natural tree corridors and orchards are the most commonly found tree components, and (5) agroforestry, managed and unmanaged plantations are least common. Finally, farmers reported a strong interest in keeping trees on organic farms although they indicated a need to be better informed about agroforestry principles and guidelines for implementation and management of trees on their farms.

Introduction

Although conventional agriculture is currently predominant in the United States, agricultural changes in the direction of more sustainable practices, such as organic farming, are gaining support among United States citizens. According to Williams, Gordon, Garrett, and Buck (1997), increased interest in alternative agricultural practices in North America is due to environmental concerns, demographic shifts, and changes in rural economies and land-use. As these practices increase in popularity among farmers, and the general public's concerns about agricultural practices and new food production systems grow, a recurring theme in the public and scientific debate is that diversity leads to increased stability.

Diverse farming systems rely on interactions among diverse agricultural components such as trees, agricultural crops, and animals within the same land management scheme to meet quantitative as well as less tangible crop production needs. These needs include economic and agricultural diversification, environmental impact mitigation, land and water rehabilitation and restoration, increased or decreased food production to better meet demands, sustainable use of land and resources, and natural habitat enhancement (Williams et al., 1997). The inclusion of trees as an active component within diversified farming techniques is of particular interest because trees can make multiple contributions to the process of growth and renewal in holistic farming systems (Regmi & Weber, 1999; Williams, et al., 1997).

This growing trend in the direction of more diversified and sustainable farming practices is still far from a dominant force in agriculture in the United States, however

(Regmi & Weber, 1999). Large scale production of both plant and animal crops using maximal mechanization and external strategies for pest control and soil restoration have predominated in the United States for the last 50 years and thus created a standard of production dependent on monoculture designs (Lassoie & Buck, 2000). Large-scale production of a single commodity such as produce, trees or livestock has been directly and indirectly encouraged and subsidized by the federal government. The recognition that these long-standing, conventional practices will most likely have serious negative and long-term consequences in the form of pollution and degradation of once fertile land, may be a driving force in the recent surge of support from the agricultural industry and government for more organic and sustainable farming practices.

Several different crops grown on smaller plots of land are representative of the majority of organic farms in the U.S. The average number of acres in organic farming production according to the *Final Results of the Third Biennial National Organic Farmer's Survey Results* of 1997 was 140 acres (Walz, 1999). This is smaller than the typical conventional farm. Farmers who choose to establish and maintain organic systems, like those described above, recognize the potential to decrease their reliance on pesticides and external fertilization.

More diverse polycultural farming systems generally require fewer chemical inputs to maintain soil quality (Mollison, 1997). Increasing the variety of plant species in a single system increases the insect and biological diversity, creating a more balanced and healthy system. Bill Mollison refers to these systems as "ecologically sound" (1997, p. 1). "If we have a system with diverse plant and animal species, habitats, and microclimate, the chance of a bad pest situation arising is reduced." (Mollison, 1997, p.

26). He goes on to discuss the differences in landscape appearances of highly diversified systems versus more common monoculture systems that are strict, ordered, linear, and segmented. (Mollison, 1997). Like Mollison, other recent authors writing about the consequences of current land use practices support the idea that increased diversity creates more stability in farming systems (http://www.attra.org/attra-pub/intercrop.html; Buck, 1997; DeVore, 1999; Mollison, 1997; Williams et al., 1997). For example, properly maintained agroforestry environments foster inter-species competition, which decreases the chances for major pest outbreaks. Ecological benefits that can be enhanced by biodiversity in agriculture include prevention of soil erosion, enhanced infiltration of water, reduced run-off, nutrient cycling, stabilization of local microclimate, regulated abundance of undesirable organisms, and detoxification of noxious chemicals already present in the soil (Altieri, 1999). Thus, diverse farming systems can help farmers find better, more efficient, and more lucrative strategies of farming, while maintaining the healthy status of the land.

Most organic farmers also believe the quality of the products they raise with more diverse systems is nutritionally superior and an increasing percentage of the consumer market appears to agree with them (Hart, 1999). The demand for organically grown products has increased steadily over the last two decades (Mollison, 1997). Although there is little current research devoted to more diverse, organic, and sustainable farming practices, the interest is growing and is driven by farmer interest, government concern, and consumer demand.

Along with the growing interest in more diverse, organic and sustainable agricultural practices, there is a renewed interest among the farming community and

researchers in the incorporation of trees into farmscapes. The roles of trees in agriculture are quite diverse and highly beneficial to farming systems (Burley, 1987). Field borders and natural tree lines may decrease pest problems by increasing the number of resident beneficial insects (Bhar & Fahrig, 1998). Subsistence farmers both in developing countries and in small numbers within the U.S. rely on highly diversified agricultural systems that include tree components to meet the nutritional needs of their families (Lassoie & Buck, 2000). These systems have been most frequently studied in the tropics and other developing countries (Lassoie & Buck, 2000).

While the effects of trees in these systems have long been recognized as potentially beneficial, the study of trees integrated into agricultural systems is a fairly recent phenomenon that has evolved into a discipline known as agroforestry (Bene, 1977). John Bene (1977) is credited as the first person to describe agroforestry as a discipline. A very basic definition of agroforestry refers to the combining of agricultural crops, including animals (i.e., livestock) with a woody component (i.e., trees). Although most definitions involve both trees and agriculture, opinions vary on how these components are involved.

Lassoie and Buck (2000) emphasize the importance of biophysical interactions between crops and the deliberate manipulation and management of such crops to create an intensively managed system. Gordon, et al. (1997) discuss trees being added or incorporated into already established farming systems. Elvitch and Wilkinson (2000), on the other hand, focus on the integration of a woody component with agricultural crops and/or livestock to optimize ecological and economic benefits. Mollison (1991) does not use the term agroforestry, but describes a much-involved system of plants and animals to

create a healthy, balanced and self-sustaining food production system. Mollison's view coincides with Masanobu Fukuoka's (1987) teachings on natural farming. He advocates food production systems that mimic nature and work as a closed-system, demanding no outside inputs.

Agroforestry has been a common practice and discipline mostly in the tropics and developing countries (Gordon, Newman, and Williams, 1997). However, some studies indicate that North American farmers are practicing agriculture techniques that could be classified as agroforestry (Gordon, et al., 1997; Lassoie et al., 2000; Williams et al., 1997). More information is needed about the agroforestry practices of farmers in the United States and other temperate regions.

Agroforestry may also provide a means to redress the decline in biodiversity on farms in the United States (Lassoie, 2000; Williams et al., 1997). Historically, the fundamental roles of trees (e.g., habitat refuge, nutrient cycling, soil protection) have become less important. More emphasis has been put on intensive production of fast growing tree products for wholesale markets and mass production of timber. Natural forestlands are often cleared for agricultural production (Williams et al., 1997). In addition, a primary drawback of conventional agricultural production systems is their reliance on massive amounts of external inputs (i.e., synthetic fertilizers, pesticides and herbicides), most of which are non-renewable (e.g., petroleum-based products) (Fukuoka, 1987). This dependence on artificial renewal of the soil results from the soil's inability to support such growing strategies. More diverse farming systems that incorporate tree components, including agroforestry, may be an alternative.

To address the lack of information currently published regarding tree component use and agroforestry in the United States, a nationwide survey of organic farmers was conducted. The survey gathered information on the current use, knowledge base and attitudes among organic farmers in the United States regarding tree components on their farms. In this study, tree components included managed and unmanaged plantations, natural tree lines and corridors, orchards, and agroforestry. See Appendix 2 for definitions.

The purpose of this study was to determine whether or not organic farmers are perceiving or gaining all potential benefits from trees in their farmscapes. According to the literature, tree management practices not only contribute to higher diversity and stability of farm ecology, but also enhance the financial benefits both directly and indirectly (Burley, 1987; Nair, 1993). The literature also suggests that although trees are commonly found on farms, they are not commonly integrated into agricultural systems in the United States. In fact, according to Williams et al. (1997), "many woodlots (and other natural areas) have been cleared for cropland or pasture, subdivided and sold for rural homes, developed for intensive urban uses or targeted as routes for transportation corridors" (p. 14).

Three hypotheses were generated to address the study's purpose stated above. The first hypothesis is that farmers do not perceive all the potential benefits that can be received from trees in the farmscape. The second hypothesis states that organic farmers are not gaining all the potential benefits of trees in their farmscapes. The third hypothesis is that there is at least one tree component present on every farm. A survey of farmers

addressed these hypotheses, as well as providing insight into farmers' use of agroforestry, and other less integrated tree components.

In addition to the literature review and background above, a detailed methodology is presented outlining the steps involved in the development and distribution of the survey, data entry, and analysis of the results of the survey of organic farmers. The results section provides descriptive statistics, including means, medians, and ranges of survey results. In addition, a sub-sample of non-respondents contacted in a follow-up survey was compared to the original respondents to evaluate the representative ness of the sample. The final section discusses the relevance of the results of this survey as well as ambiguities present in the study and future directions for additional research in this area.

Methodology

Survey

Survey Development:

Several steps were taken prior to creating the final survey. A preliminary farm tour was conducted to get a visual perspective of the type of farms described on the Appropriate Technology Transfer Association for Rural Agriculture (ATTRA) "Internship and Apprenticeship" website. Four farms were toured in the northeast region of the United States (i.e., Maryland, West Virginia, and Pennsylvania). The farm owners or managers were interviewed using a short questionnaire designed to elicit responses regarding demographic information of interviewee, information sources used to gain knowledge about farming, knowledge of alternative farming practices, tree components

on the farm, benefits and drawbacks perceived by farmers with respect to trees on the farm, and future plans regarding trees. This provided descriptive information about how farmers respond to various questions and the variety among farms in terms of structure and function. This process also provided some important insights into survey design that aided in the development of a pilot survey.

Dillman's (1999) current guide to survey design methods also aided in the development of a pilot survey and the final survey that was distributed to sample populations of organic farmers. Strategies utilized in the survey preparation from Dillman's guide included statistical reports of various survey strategies depicting their success rate, logical and researched reasoning to support the various survey outcomes, and trade-offs among survey approaches. Dillman's (1999) comparison of internet surveys received via e-mail versus standard post or hard copy administered surveys provided statistical support regarding their success rates. Evidence pointed to the efficacy of e-mail survey design as the best method, particularly given the time constraints of the project. Dillman (1999) also provided valuable information regarding the structural components necessary for successful delivery and response via e-mail.

The pilot survey was sent by e-mail to people within the local sustainable agriculture community, four NCSU professors, and a subset of 40 randomly selected farmers with e-mail listed on the ATTRA website. The final survey was distributed to 170 farmers in two separate samples. The first was comprised of the 161 farmers with e-mail addresses listed on the ATTRA website for "Internships and Apprenticeships." Of these 161, 43 returned the survey for a 27% response rate. The second sample was comprised of 9 organic farmers who participate in the Farmers' Market in Carrboro,

North Carolina. All 9 farmers returned the survey after being approached by the researcher at the market and asked to respond (i.e., 100% response rate). (A copy of the survey may be found in Appendix 1.)

Distribution of Survey:

The survey was distributed via e-mail to the 161 farmers from the ATTRA website and by hand to the 9 organic farmers participating in a local farmer's market. An introductory letter was composed to describe the researcher's intent and the goals of the project as well as to promise confidentiality. A summary of the findings to be developed from the survey findings was offered to each participant who completed and returned a survey. The survey was sent on July 14, 2000 to the entire 161 farmers with e-mail addresses. Responses were entered as they were received into the database, and respondents were deleted from the list of surveys to be resent. A second survey was sent on August 15, 2000 and included a new introductory letter encouraging farmers to take the time to complete the brief survey. A final electronic mailing went out on September 15, 2000 to all those who had not yet responded to the survey. Again, an introductory letter was drafted emphasizing the importance of completing the survey. In the e-mailed version of the survey, farmers had a choice of sending responses by e-mail or by standard post. The local group received hard copies of the survey on September 30th and October 7th of 2000. One farmer responded via standard post and the other eight respondents elected to hand their completed forms directly to the researcher.

Survey Data Entry:

Data were entered into an Excel spreadsheet as responses were received via e-mail, farmer's market collections, and standard post. Responses to close-ended questions were coded numerically, and comments to open-ended questions were entered verbatim. ATTRA categorizes farms by geographic region and thus data was entered in this fashion: Southeast, Northeast, North Central, North West, and Local. Originally the "Local" group represented organic farmers from the Carrboro Farmer's Market, but due to the low numbers of local responses, they were merged with the Southeastern group. The number of responses per region was low and thus no comparisons between regions could be pursued. All regions were combined to give overall responses to survey questions. Farmer demographic information including sex, age category, and education level, and respondent's position on the farm were entered as discrete variables according to the choices provided in the survey. Farm descriptors included total farm acreage and farm acreage in marketable production. These responses were entered as continuous variables. Responses to choice questions regarding farm tree components, benefits and drawbacks of trees, marketing strategies used, and information sources, were entered as binomial data with 0 indicating "no" and 1 indicating "yes".

Survey Data Analysis:

Excel was used to calculate descriptive statistics for each question on a spreadsheet and this facilitated calculation of descriptive continuous statistics. Responses were summarized as means and medians. Discrete and binomial variables were expressed as raw ratios or frequencies. (See Appendix 4 for a complete set of results.)

Sub-sample Survey

Development, Distribution and Responses:

A second telephone survey was conducted with a random sample from the 53 initial non-respondents from the ATTRA website (Appendix 3). A list of 24 non-respondents was generated using the randomization function from the statistical program JMP. Five questions from the original survey were asked over the telephone. Several were re-worded to obtain a single response, but still provide adequate information for comparing the respondents and non-respondents. Responses from the sub-sample were entered into an Excel spreadsheet and organized for analysis and comparison with the original survey data.

Data Analysis of Sub-sample Survey:

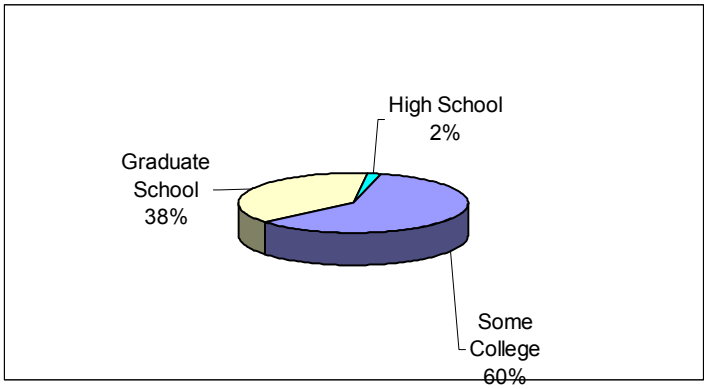
Responses to the original survey and the sub-sample survey were tested for statistical differences. Three of the five questions were selected because of their core relevance to the survey and analyzed. They were 1) which is the primary tree component; 2) whether trees are integral to cash crop production; and 3) whether cash crops are received from trees? See Appendix 3 for sub-sample questions. A Z-score calculation with a 95% confidence interval for the three questions was calculated to test for a significant difference between the two sample populations surveyed (Johnson and Berk, 2000).

Results

Farm Profile:

There was a 27% response rate for all farmers surveyed from the ATTRA website and 100% response rate for all farmers surveyed from the Carrboro Farmers' Market. Fifty-one total responses were received out of the total of 170 farms surveyed amounting to a 30% response rate when both sample populations are combined. The average farm size was 97 acres (median 56 acres) with a mean of 36 acres in marketable production (median 10 acres). Sixty-one percent of the responses were from males, and 39% were from females. Eighty-eight percent of the respondents were above the age of 30, with the majority (59% of total responses) being above the age of 40. Only 12% fell in the lowest age group of 20-29 years. Every farmer, except one, had at least some college education (Chart 1).

Chart 1: Education levels of organic farmers



There was not much variation in marketing strategies reported. Most farmers participate in at least one farmer's market (63%), over half are involved in Community Supported Agriculture (CSA) (55%), and almost half participated in wholesale distribution to restaurants (45%) and grocery stores (41%).

All farms had at least one tree component, and the majority (59%) had 2 or 3 tree components. Two farms had six tree components. The most common tree components

were natural tree line and corridor, followed by orchards, and then unmanaged plantation, agroforestry and managed plantation. Farmers reported plans for adding between one and three new tree components on their farm. A third of the respondents are interested in establishing orchards and 24% plan to incorporate new agroforestry systems into their farmscape. Table 1 below summarizes responses regarding current and future tree components on organic farms.

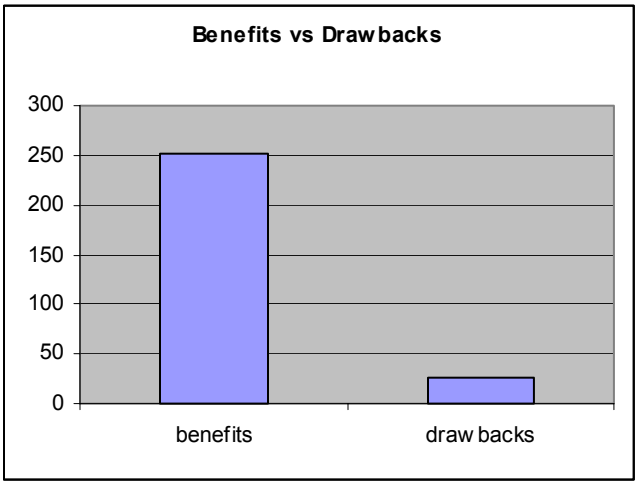
Table 1: Distribution of tree components found on farms currently as well as future plans regarding additional tree components

Tree Components	Agroforestry	Managed Plantation	Unmanaged Plantation	Natural Tree Line	Natural Tree Corridor	Orchard
Current	12	11	13	26	34	28
Future	12	4	2	6	8	17

Interestingly, 75% of the farmers who currently reported having agroforestry planned on expanding on their already established agroforestry component or adding additional agroforestry to the farm in the future. In other words, 25% of the farmers who plan to have agroforestry in the future do not currently. Smaller interest was reported in developing natural tree corridors (16%), tree lines (12%), and managed (8%) and unmanaged plantations (4%). Other future interests indicated by the farmers were timber harvest (25%), windbreaks (14%), and removing trees for crop production (8%) in the future.

When asked about benefits and drawbacks of trees currently on the farm, the respondents cited a high number of benefits and few drawbacks (Chart 2).

Chart 2: Total number of responses from 51 farmers regarding benefits and drawbacks received from trees on the farm.



There were 252 responses among 8 categories of benefits compared to 27 responses among 5 categories of drawbacks. Aesthetics was the most frequently mentioned benefit (90%). Windbreak provided by trees was the second most popular benefit (75%). Beneficial insects, privacy, and wildlife were evenly distributed as the third most popular benefits (69% each). Shade ranked fourth, with 33 responses from 51 farmers (65%). Cash crops (39%) and fodder (20%) were least popular among possible benefits listed in the survey. Pests (e.g., deer) were the number one drawback farmers reported from trees on their land (27%). Fourteen percent found shade to be a problem, although there was a much higher percent (65%) of farmers who found shade to be a benefit. Labor and tax drain were the least often mentioned of the drawbacks, reported by 10% and 2% of farmers respectively. All multi-response questions had a category titled "other" for farmers to fill in if they wished to add a response not listed on the survey. "None" was the most common response among farmers who filled in the blank for the question regarding drawbacks.

When asked the question, "Is having a tree component integral to cash crop production?" responses were most often "no"(56%). Thirty-eight percent said, "yes", while 8% answered that they did not understand the question. The most common marketable product farmers sell from trees on the farm is produce, including fruits and nuts from orchards (39%). Twenty-five percent responded that timber was lucrative, followed by animal products (dairy, meat, eggs) at 24%. Wildcrafting and fodder were the least common marketable products from trees at 12% each. Please refer to Appendix 4 for raw data tables and charts on marketing strategies reported by farmers.

Sub-sample Results:

No statistically significant differences were found in the proportion of responses to questions in the sub-sample survey compared to the full survey. The sub-sample survey was drawn from non-respondents from the ATTRA website only. The test did not include the nine farmers from the local sub-set. This result indicates that responses to the full survey are not significantly different from responses by the rest of the ATTRA sample. Therefore, results from the full survey are representative of all farmers listed on the ATTRA website. (See Appendix 5 for sub-sample data tables).

Discussion:

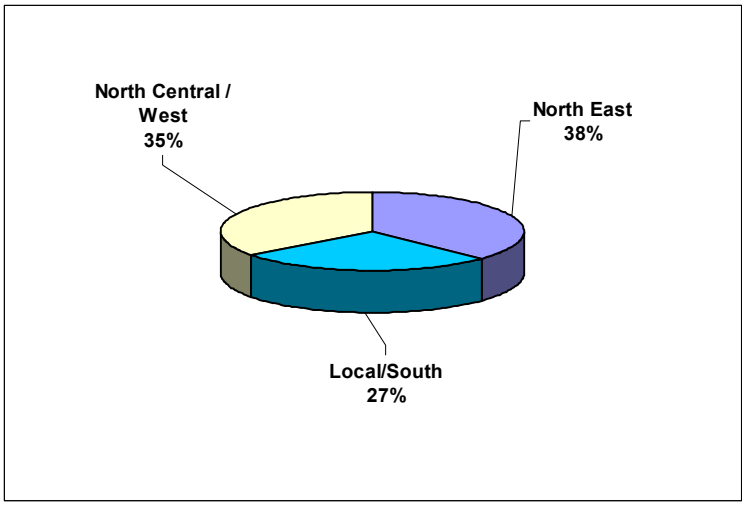
The results of this study suggest that most organic farmers are well educated, middle aged or older, and have trees in their farmscapes. Average total farm size did prove to be small, i.e., under 100 acres, with very small average productive acreage in

comparison to large-scale conventional agriculture. When medians were calculated, it was evident that one or two extremely large farms increased the average farm size. The median for productive acres was only 10 acres as opposed to the mean calculation of 36 acres. Most farmers pursued a variety of marketing strategies. Although these trends may indeed represent the current profiles of organic farmers and their farmscapes, the results may have also been influenced by the survey design, sample population biases, and other characteristics peculiar to the samples used in this study. Further research should be undertaken to either verify or suggest modifications to the current findings. Research in the form of surveys as well as non-survey research such as key informant projects would be useful in obtaining useful information regarding all aspects of organic farming across the United States. Other sampling frames could be used in future studies, such as organic farming organizations.

Appropriate Transfer Technology for Rural Agriculture (ATTRA) is an organization geared to providing educational information and programs regarding sustainable agriculture. This may represent a bias with respect to the educational status of organic farmers. The bulk of farmers sampled (95%) are listed under ATTRA's "Internship and Apprenticeship" web page. One might speculate that because these farmers are actively using e-mail and the Internet as well as participating in web-based educational programs, that the responses regarding education level were somewhat inflated in comparison to the mean educational level of all organic farmers.

The data were categorized by region: north central and west, northeast, and the local subset combined with the southeast region from ATTRA. Distribution of responses was fairly even, as can be seen in chart 3.

Chart 3: Distribution of Survey Responses



Although data were originally categorized by region, after tabulating the results it was evident that regional distribution was not adequately represented due to the low numbers of responses in each region. Therefore the data were tabulated to provide total values of responses to each question representing organic farmers across the nation. This precludes arguments regarding regional differences among respondents. One might argue that varying regions have different needs as far as farm design strategies and management, as well as differing markets and environmental concerns. The literature reviewed on this topic suggests that integrated farm management strategies are based on basic principles and guidelines that facilitate site-specific methods and practices (Burley, 1987; Mollison, 1997; Williams et al., 1997). Thus, interactive farm management strategies involving multiple components, including trees, are plausible on all farms regardless of region.

The fact that farmers listed many more benefits than drawbacks to tree components is an important result. However, one caveat on this finding is that the survey design allowed for more responses to be checked off regarding benefits than drawbacks. There were seven listed benefits not including a space captioned “other” for another

answer to be filled in, while there were five drawbacks listed, plus an "other" category. Shade was a shared response, listed as both a benefit and a drawback. Although the substantial number of responses regarding benefits could have been driven by the design of the survey, it is important to note that the most popular response in the "other" category for drawbacks was "none". It is also interesting to note that farmers most frequently listed the aesthetic pleasures of trees as a benefit as opposed to other choices. Because the majority of farmers felt that trees are not integral to cash crop production yet listed numerous commodities grown with the influence of trees and sold for cash it is indeed possible that farmers are not perceiving all the benefits of trees on their land. There is substantial literature discussing the multitude of benefits from incorporating trees into the farmscape (Addlestone, 1999; Altieri, 1999; Lassoie, 2000; Mollison, 1997; Rodale, 1983; Williams et al., 1997.).

In regard to the number of tree components per farm, every farmer had at least one tree component, and many had two or three. This supports the hypothesis that all organic farms have at least on tree component on their farm. The presence of trees adds diversity, according to the literature, and creates a balance at the ecosystem level that supports healthy competition among species of insects and organisms above and below ground aiding in the prevention of pest problems (Mollison, 1997; Altieri, 1999; Williams et al., 1997.).

Williams et al. (1997) point out that while agroforestry practices are concentrated in developing countries, especially in the tropics, there are a surprising number of farms in North America that could be classified as incorporating agroforestry systems. The survey results show that 24% of farmers are currently using agroforestry and 24% plan to

add new agroforestry in the future. Interestingly, only a quarter (6%) of those farmers planning to add agroforestry in the future do not currently have agroforestry. In other words, 18% of all the respondents currently have agroforestry and those same farmers are planning to expand or add more agroforestry to their farmscapes in the future. This suggests that agroforestry provides benefits to farmers great enough for them to increase their current agroforestry management practices. Farmers currently practicing agroforestry (24%) perceive these benefits and thus plan to increase or continue such practices.

Agroforestry is a much more interactive tree-based system as opposed to tree components that stand alone, such as an orchard or plantation. The fact that more farmers have natural forest currently and plan to implement less interactive tree components (i.e., not agroforestry) in the future, suggests that farmers: (a) may not be aware of the concept of interactive farmscapes, (b) do not know how to implement such practices on individual farms, or (c) are comfortable with the current status of their farms and feel there is no need to implement more interactive tree components. Although many respondents have future plans to expand or add at least one tree component on their land, the survey design provided more possible options for future plans than for current tree components. This may have biased the results.

Farmer perspectives affect the management strategies used on each farm. A study of farmers' attitudes and resulting actions by Erickson and DeYoung (1994) finds that "an awareness of the benefits derived from trees and an aesthetic and intrinsic orientation toward the land is associated with more attention to woodlot and windbreak management, while an extrinsic (e.g., economic) orientation toward farming is predictive of less

attention to these practices" (pg. 245). They go on to say that a better understanding of the multidimensional and often subtle set of forces that help to shape the rural landscape might prove useful in promoting more sustainable farm management. Another multi-disciplinary research project funded by the Southern Region of SARE, found that "farmer adoption of sustainable practices occurs when training and technical assistance are hands-on and readily available, and when market incentives are strong" (Common Ground, 1999; pg. 4). These two studies along with the low number of farmers projected to implement agroforestry techniques who do not already have them established, support the idea that increased awareness and knowledge of alternative farming practices along with some hands-on guidance could foster greater acceptance and use of such techniques.

Survey findings indicate that 88% of organic farmers have received some income from commodities produced with the influence of trees. Farmers may not be fully utilizing this opportunity, since the majority (54%) indicated that trees are not integral to cash crop production. Literature review coupled with the 38% of affirmative answers to the question regarding income received from tree components shows that monetary gains can be successfully generated through careful incorporation of trees into the farming system. Some of the best examples of creating cash crops from trees, according to the literature, are entomoforestry (i.e., beekeeping), orchards or timber plantations accompanied by livestock or chickens (silvipastoral and agrosilvipastoral), as well as annual crops grown in conjunction with tree crops (agrisilvicultural) (Nair, 1993; Williams, 1997).

The statistical test showing that there is no difference between the respondents and non-respondents is valuable. There was no test conducted in regards to the small

group of local farmers (9) who participated in the survey. There were no non-respondents in this group, as all farmers approached were willing to participate in the study. This suggests that a more personal approach to administering a survey may tend to reap a higher response rate than electronically based surveys.

More studies involving on-farm testing and experiments are necessary in order to test the idea that trees interactively implemented into a farming systems yield economic, ecological, and physical benefits. Follow-up studies to this one would also be helpful in determining farmers' perspectives on alternative farming practices involving trees. This study could have been improved through more careful clarification of survey questions and maintenance of stronger consistency throughout the questionnaire. A higher response rate might also have been obtained if the survey was administered during the off-season. Some farmers responded that they were much too busy to fill out the survey during the months of June, July and August, when this survey was distributed. The relevance of this study is in its provision of an information base that will facilitate future research in this arena. As interest in alternative farming practices increases, it is necessary to have solid research including field studies and farmer input from surveys. This study indicates that although farmers have trees in their farmscapes, the majority perceive aesthetics to be the number one benefit. Extensive literature review on this topic reveals that many other benefits can be obtained to enhance the farming system and reap economic benefits as well as non-economic gains.

The key research question addressed in this study is whether farmers are perceiving or gaining all of the potential benefits of trees on their farms. Findings indicate that they are not, although there were limitations on testing these hypotheses.

For instance, farmers were not surveyed regarding what they do not know (for example, their awareness of the benefits of trees), and the trade-offs between benefits and drawbacks were not tested. One drawback could be much more harmful to a farming operation than one benefit. Because farmers found less interactive and non-economic benefits such as aesthetics and privacy to be high on their list of benefits, it could be surmised that they are not gaining all the possible benefits as found in the literature review. When farmers were asked if they thought trees were integral to cash crop production, the majority responded negatively, although numerous cash crops produced with the influence of trees were reported by those same farmers.

Interestingly, current agroforestry users made up 75% of the farmers who plan to implement new agroforestry in the future. Only three farmers, who do not currently have agroforestry on their farms, plan to add it in the future. This suggests that most farmers with agroforestry recognize its benefits and thus plan to expand it, while farmers who have not yet been introduced to agroforestry may not recognize its benefits. Thus, greater education and outreach may assist more farmers to reap the benefits from more interactive farming practices involving trees, which can potentially provide numerous economic and non-economic benefits.

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Appendices:

Appendix 1: Survey Regarding Trees on Organic Farms

Farm Name: _____

Your First Name: _____

Your Position:

Owner	___
Manager	___
Other	_____

Total Farm Acreage: _____acres
Acreage in Marketable Production: _____acres

What tree components do you have on your farm? (type acres for all that apply)

Agro forestry _____acres
-Growing of both agricultural and timber crops together
Managed Plantation _____acres
-Management of trees to keep them healthy and maintained; harvesting and replanting
Unmanaged Plantation _____acres
-Intentionally planted timber crop left to grow with no maintenance
Natural Tree Line _____acres
-Native forest present along perimeter of farm or portion of farm edge
Natural Tree Corridor _____acres
-Natural forest growth in a strip or section within the farm property
Orchard _____acres
-Intentional planting of fruit/nut trees
Other: _____ _____acres

What benefits do you receive from tree components? (Type all that apply)

Aesthetics ___
Beneficial insects ___
Privacy ___
Cash Crops ___
Wildlife ___
Shade ___
Windbreak ___
Fodder ___
Other: _____

If producing cash crop(s) from tree component(s), please indicate what they are:

Mushrooms ___
Medicinal herbs/ Wild crafting ___
Timber ___
Animal Feed ___
Produce ___
Fruit/Nuts ___
Meat ___
Dairy ___
Eggs ___
Compost ___
Other(s): _____

Is having a tree component integral to cash crop production on your farm?

Yes ___
No ___

Marketing tactics used on your farm: (Mark all that apply)

Farmers Market ___
Multiple Farmers Markets ___

Community Supported Agriculture (CSA) ___
Restaurants ___
Grocery/Health food stores ___
Other (please specify) _____

Drawbacks from tree components: (mark all that apply)

Pests ___
Labor-intensive ___
Unproductive land ___
Tax drain ___
Shade ___
Other: _____

Future plans regarding trees on the farm property: (mark all that apply)

Agro forestry ___
Establish new managed plantation ___
Establish new unmanaged plantation ___
Establish tree line ___
Establish tree corridor ___
Orchard ___
Establish a windbreak ___
Remove trees to increase crop production ___
Harvest trees for timber profit ___

What current information sources are used regarding farming and your land? (Mark all that apply)

Journals/Magazines ___
Books ___
County/State Cooperative Extension Services ___
Conferences ___
Web ___
Growers Association(s) ___
Fellow farmers ___
Other (please specify) _____

Would you be interested in learning more about the potential benefits of trees?

Yes ___
No ___

If yes, which sources of information/education would you utilize? (Mark all that apply)

On-site consultation ___
Off-site course ___
Journal subscription ___
Internet ___

Newsletter subscription ___
Network of local farmers ___
Conferences ___
Growers Associations ___
E-mail ___
Other: _____

Sex: Male ___
Female ___

Age: 20-29 ___
30-39 ___
40-49 ___
50-up ___

Educational background of the owner/manager or most intimately involved person:
High School ___
Some College ___
Graduate school ___
Other _____

Would you like to receive a report of the results of this survey?
Yes ___
No ___

If you have any thoughts, ideas, questions, or concerns please use the space below to express them. I would appreciate any thoughts you may want to share regarding this survey and tree components on your farm.

Thank you again for your time and efforts.

Appendix 2: Relevant Definitions

Agroforestry – An established land-use management system, of long-term and short-term crops, combining woody, non-woody, and/or animal components that relate both structurally and functionally to promote one or more of the following; ecology, economics, biology and physical benefits.

Silvopastoral – Animals (i.e., Pasture) and a woody component.

Agrisilvicultural – Annual crops and a woody component.

Entomoforestry – Insects and a woody component (i.e., Beekeeping, silkworms and mulberry)

Agrisilvopastoral – Annual crops, animals (i.e., Pasture), and a woody component.

Appendix 3: Sub-sample Survey Questions

Administered by telephone to a randomized list of non-respondents:

1. Did you receive the survey?
2. What is the primary tree component on your farm?
3. Do you receive cash income from trees on your farm?
4. What is the main benefit received from trees on your land?
5. Is having a tree component(s) integral to crop production?

Appendix 4: Survey Raw Data

***All totals not equal to 51 are a result of multi-response questions.

Position of Respondent	
Responses	**Number**
Owner	36
Manager	15
Total	51

Current Tree Components	
Responses	**Number**
Agroforestry	12
Managed Plantation	11
Unmanaged Plantation	13
Natural Tree Line	26
Natural Tree Corridor	34
Orchard	28
Total	124

Benefite Precieved from Trees	
Responses	**Number**
Aesthetics	46
Beneficial Insects	35
Privacy	35
Cash Crops	20
Wildlife	35
Shade	33

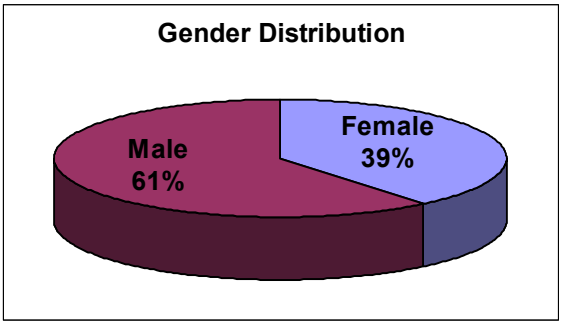
Future Plans for Trees	
Responses	**Number**
Agroforestry	12
Establish mgd.Plantation	4
Establish unmgd.Plantation	2
Establish tree line	5
Establish tree corridor	8
Orchard	17
Establish windbreak	7
Remove; increase crop production	4
Havest for timber profit	13
Total	72

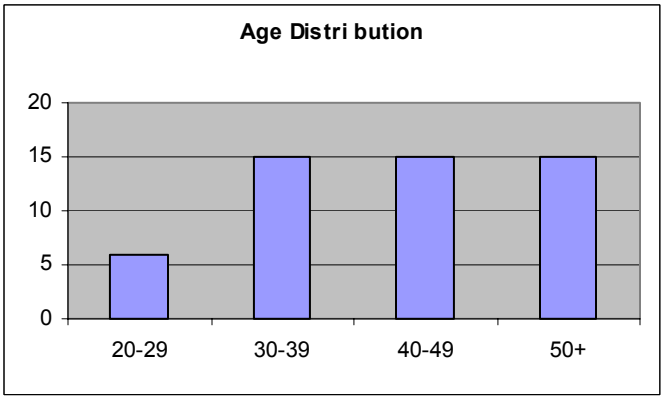
Current Info. Sources used	
Responses	**Number**
Journals/Magazines	40
Books	38
Cooperative Extension Services	22
Conferences	30
World Wide Web	22
Growers Association	20
Fellow Farmers	35
Total	207

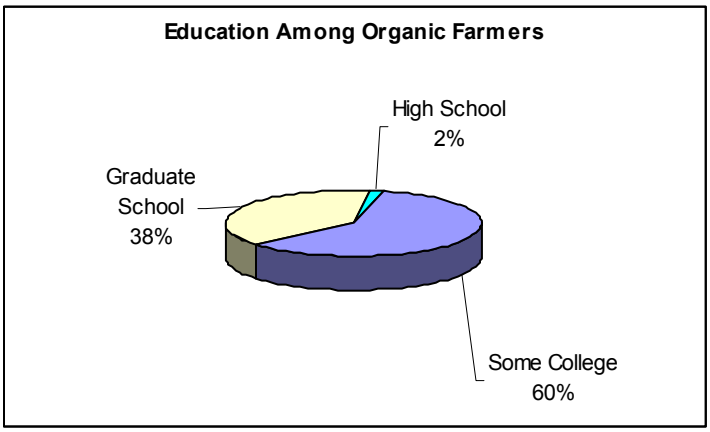
Windbreak	38
Fodder	10
Total	252
Cash Crops Produced from Tree Components	
Responses	**Number**
Mushrooms	4
Herbs/Wildcrafting	4
Timber	13
Animal Feed	6
Produce	5
Fruits/Nuts	15
Meat	5
Dairy	4
Eggs	4
Compost	4
Total	64
Are Trees Integral to Cash Crop Production?	
Responses	**Number**
Yes	19
No	28
Don't Know (?)	4
Total	51
Marketing Tacticts Used	
Responses	**Number**
Farmers Market	21
Farmers Markets	11
CSA	28
Restaurants	23
Grocery/Health Food	21
Total	104
Drawbacks from Trees	
Responses	**Number**
Pests	13
Labor-intensive	5
Unproductive land	0
Tax Drain	1
Shade	6
Total	25

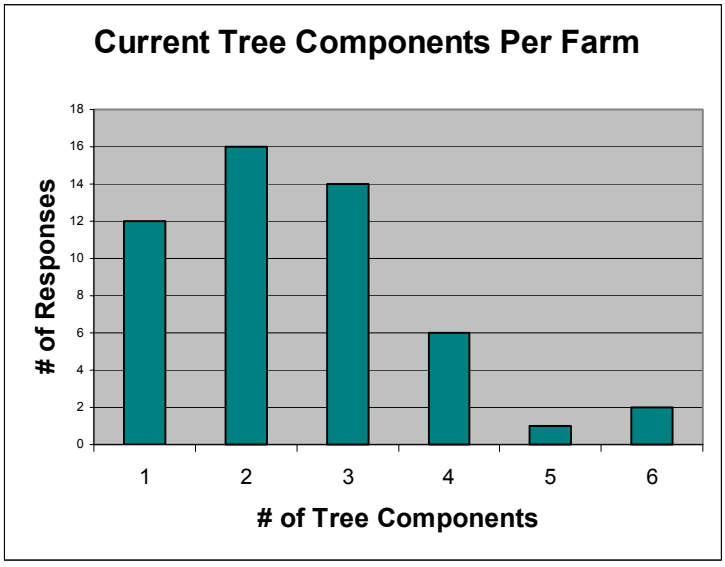
Farmers Interested in More Info. On Tree Benefits		
Responses	**Number**	
Yes	36	
No	11	
Total	50	
Preferred Information Sources		
Responses	**Number**	
On-site Consultation	19	
Off-site Course	6	
Journal Subscription	9	
Internet	17	
Newsletter Subscription	18	
Network of Local Farmers	15	
Conferences	20	
Growers Association	11	
E-Mail	14	
Total	129	
Sex of Respondents		
Responses	**Number**	
Male	31	
Female	20	
Total	51	
Age Group Distribution		
Responses	**Number**	
20-29	6	
30-39	15	
40-49	15	
50+	15	
Total	51	
Educational Background of Respondents		
Responses	**Number**	
High School	1	
Some College	30	
Graduate School	19	
Total	50	

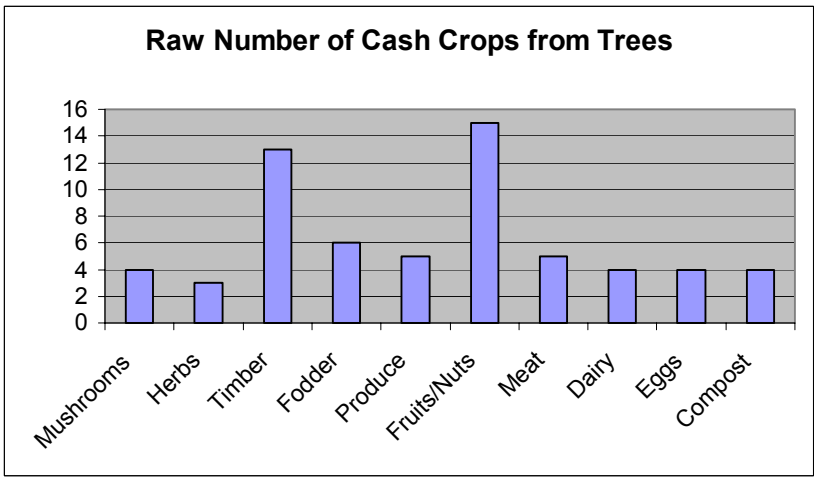
Appendix 5: Data Charts and Graphs:


Gender Distribution
Female
39%
Male
61%


Age Distri bution
20
15
10
5
0
20-29
30-39
40-49
50+


Education Among Organic Farmers
High School
2%
Graduate
School
38%
Some College
60%





Appendix 6: Sub-sample Raw Data Set

Number of Responses to Questions:

Primary Tree Component on Farm	
Responses	**Number**
Agroforestry	1
Managed Forest	1
Natural Forest	16
Orchard	6

Cash Received from Trees

Responses	Number
Yes	14
No	10

Are Trees Integral to Crop Production?	
Responses	**Number**
Yes	19
No	5