ABSTRACT

RATASKY, STEPHEN JOSEPH. Examining the Development and Management of Student Farms Nationwide: A Delphi Study and a Model for Student Farm Design. (Under the direction of Dr. Michelle Schroeder-Moreno.)

The increasing student interest in sustainable agriculture has motivated many colleges and universities to develop various sustainable agricultural education (SAE) programs. As a result of this growing interest in SAE, numerous student farms have been established in the last few years. Student farms can be characterized as campus-based educational facilities that provide multidisciplinary and experiential learning opportunities through sustainable agriculture education. While each of these student farms is unique in size, focus, regional production constraints and institutional support, they may share common challenges and educational strategies, and benefit from enhanced communication and collaboration efforts. There is currently a dearth of research, however, that has investigated these commonalities among student farms. The purpose of this study was to examine the numerous developmental, managerial, and educational strategies currently being used by student farm leaders nationwide. A Delphi survey methodology utilizing three rounds of an online survey was used to gather shared expertise from twenty-four college and university student farm programs nationwide. Ten open-ended questions were distributed to student farm leaders which aimed to specifically identify successful components of student farm establishment and long-term management, student and community educational and outreach strategies, funding sources, also current challenges, issues, and their solutions. Results indicate the overwhelming importance of both a competent and knowledgeable farm manager and support staff. Each was identified as essential to the successful establishment and ongoing management of student farms. Findings from the student educational and outreach strategies

strongly emphasized the need for interdisciplinary and experiential learning on student farms. Providing student internships, experience with farm equipment, and implementing multidisciplinary undergraduate and graduate classes were among the top-rated responses. Many student farm leaders highlighted multiple aspects of community engagement, where specific activities were centered on community supported agriculture (CSA) and farmers market programs, as well as hosting educational workshops and tours. The need for increased institutional support of student farms was one of the top responses and there might be opportunities to enhance this through increased community education and engagement. Student farm leaders additionally indentified various future innovations for student farms including on-farm courses and other educational activities, as well as increasing community engagement and service-learning outreach on student farms.

The third chapter of this thesis aimed to present an introductory guide to designing and developing a student farm. Currently there are no models or described strategies for a holistic student farm development that includes a design process guided by educational objectives, budget development, and a communication plan. Findings identified by the Delphi study in Chapter 2 were integrated with experiences from sustainable agriculture experts at North Carolina State University (NCSU) to create an in-depth student farm development plan that can be useful for beginning a student farm and also for those already established. This student farm development plan includes discussion on key components of forming a student farm's advisory board, mission and key objectives, land acquisition, the process of developing a farm design from the identified educational foci, and developing a farm budget and communication plan. The NCSU Agroecology Education Farm (AEF) was used as an example in the development of the mission plan and farm design process,

including a detailed base map, site analysis, schematic drawing, and final student farm design figures. The design plans and developmental guide will not only be used for establishing a new student farm at NCSU but can also serve as reference material highlighting many of the major components to successful student farm development and design. It is our hope that this can further deepen the communication efforts among student farms nationwide and highlight the importance of student farms within sustainable agriculture education programs.

Examining the Development and Management of Student Farms Nationwide: A Delphi Study and a Model for Student Farm Design

by
Stephen Joseph Ratasky

A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Master of Science

Crop Science

Raleigh, North Carolina

2013

APPROVED BY:

Dr. Michelle Schroeder-Moreno Committee Chair	Dr. Lucy Bradley
Dr. Julie Grossman	Dr. Jay Jayaratne
Dr. David Orr	

DEDICATION

This thesis is dedicated to my family, close friends, past and present colleagues who've helped steer me through this endeavor. Your inspiration, patience, and helpful support positively guided me through this process. Thank you.

BIOGRAPHY

Stephen Ratasky was born in Long Beach, CA where he lived for nearly seven years before moving to his current home of Raleigh, NC. In 2009 he received his Bachelors of Science, magna cum laude, in Horticulture from Clemson University. He was heavily involved with the Sustainable Agriculture Program and Clemson's Student Organic Farm. Stephen completed his horticulture curriculum internship with the Clemson Student Organic Farm, where he first began as a student assistant, then succeeded to develop a volunteer work program for the farm incorporating Clemson University students and neighboring community members. In 2010, he began his Masters of Science (MS) in the Department of Crop Science at North Carolina State University (NCSU) in the Agroecology and Sustainable Agriculture concentration.

ACKNOWLEDGMENTS

There are a number of people without whom this thesis would not have been possible. I would like to thank the following people who offered their expertise and valuable time to assist me in this endeavor.

Dr. Michelle Schroeder-Moreno (advisor)
Dr. Jay Jayaratne (co-advisor)
Dr. Lucy Bradley (co-advisor)
Dr. Julie Grossman (co-advisor)
Dr. David Orr (co-advisor)
Professor Will Hooker
Professor Julieta Sherk
Curtis Powell
Daniel Whittaker
Matthew Brown
Angel Cruz
Joseph Owle
José Chavíra
Rob Austin
Erika Larsen
Sam Marshall
John Beck
Andy John
Phillip St. Clair
Elizabeth Gillispie
Dolly Watson
Patty Aune

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Introduction

Nationwide there has been a recent increase in interest in sustainable agriculture and sustainable agriculture food systems education programs (Parr and Trexler, 2011; Grabau, 2006; Biernbaum, 2006; Bhavsar, 2002). Students are increasingly interested in learning sustainable food production methods (Feenstra, Haresty, Allen, and Perez, 2008; Markhart, 2006) and participating in hands-on sustainable agriculture experiences outside of the classroom (Parr and Trexler, 2011). While traditional lectures and classroom-type activities are common sustainable agriculture education (SAE) curriculum components (Ngouajio, Delate, Carey, Azarenko, Ferguson, and Sciarappa, 2006; Markhart, 2006; Delate, 2006), students identified the lack of problem-based learning and the imbalance of theory and practice as ineffective learning approaches used within SAE curriculum (Parr and Trexler, 2011). In order to engage students in experiential education in sustainable agriculture outside the classroom, a number of student farms (educational farms associated with colleges and universities) have been established from both faculty and student efforts (Parr and Trexler, 2011; Ngouajio et al., 2006; Parr and Van Horn, 2006). Currently student farms are rapidly developing and serving as educational facilities that provide a broad array of hands-on experiences for students in sustainable agriculture. Internships, apprenticeships, integrated classroom and field activities, as well as the facilitation of weekly or biweekly markets have all been successful activities used on student farms (Parr and Van Horn, 2006; Biernbaum, Thorp, and Ngouajio, 2006; Markhart, 2006). Ultimately, student farms are diverse in operation, but no studies that we are aware of have examined common development and educational strategies among successful student farms.

In addition to the increased interest in sustainable agriculture from students, nationwide community interest in sustainable and local food production has also grown.

Community members are working to establish and maintain highly-productive community gardens, as well as to implement innovative ways to strengthen local relationships and increase sustainable agriculture education (Teig, Amulya, Bardwell, Buchenau, Marshall, and Litt, 2009). These community gardens can provide numerous benefits in the form of increasing physical health, but also aid in developing skills in planning, organization, team-building, and financial management (Draper and Freedman, 2010; Bradley and Baldwin, 2011). Community gardens often suffer, however, from a lack of resource and educational materials focused on sustainable agriculture. Unfortunately, this has created a divide between a community gardens' need for up to date sustainable agriculture information and university-level research (Pawelek, Frankie, Thorp, and Przybylski, 2009). Thus, there may be strategic ways for student farms to engage community members interested in sustainable agriculture to benefit both students and the surrounding community.

Up to now, many sustainable agriculture education efforts on student farms are focused primarily on students. Additionally, SAE curriculum and more specifically student farms, often focus solely on production-type agriculture education for students. Moreover, there has not been a large effort to showcase successful student farm models and the strategic steps in establishing student farms, the basic operational and managerial components of student farms, or the importance of community involvement within college and university student farms.

North Carolina State University (NCSU) is in the beginning stages of developing a new student farm, the Agroecology Education Farm (AEF). This student farm aims to highlight sustainable agriculture practices through innovative design, provide unique experiential learning opportunities for students, and engage the surrounding community. As

a way to strategically learn from other student farms nationwide, this study was developed to identify the main educational, operational, and student and community engagement components of leading student farms across the country. The research in this study examines key components to the successful development, management and operation of student farms nationwide, while integrating community involvement within the current and future design and development of college/university student farms. To define these terms, we sought developmental suggestions as input from student farm leaders concerning the institutional support, funding and function of the student farm within the college/university; managerial suggestions describing student farm personnel (staff, faculty and administrative members) functions and roles; and operational suggestions as day to day and seasonal acitivities occuring on the student farm.

The second chapter describes a Delphi survey conducted with student farm leaders from 24 colleges and universities nationwide. Through three rounds of open-ended questioning, student farm leaders (manager and/or faculty/administrative position involved with the student farm) were presented with questions focused on the development, long-term management, student and community educational and outreach strategies, funding strategies, as well as commonplace challenges and issues inherent on student farms. Descriptive statistical data was generated for each of the responses from the student farm leaders in order to help understand consensus around the working components of student farms nationwide.

The third chapter of the thesis describes an in-depth process of designing and developing a college/university student farm. Lessons learned from Chapter Two's findings were coupled with the expertise from an advisory board of the Agroecology Education Farm (AEF) at North Carolina State University. Various professionals from the NCSU

departments of Crop Science, Soil Science, Horticulture Science and Entomology serve on the advisory board and their knowledge and experience was integrated with a multi-step design and development process described in this chapter. Suggestions on how to properly develop educational foci, select an appropriate site, a detailed farm design plan, budget plan, as well as communication plan were all described in the chapter. Ultimately, through the input of nationwide student farm leaders, coupled with the supportive direction of sustainable agriculture education experts, this thesis aimed to serve as an innovative model for student farm development and design, while further strengthening the communication and collaborative efforts among student farms.

REFERENCES

Bagdonis, J. M., C. C. Hinrichs, and K. A. Schafft. "The Emergence of Framing Farm to School Initiatives: Civic Engagement, Health and Local Agriculture." *Agriculture and Human Values* 26(2009): 109-117.

Bhavsar, V M. "Certified Organic Farming Principles and Practices: a Course Linking Farmers and University Students." *Journal of Natural Resources* 31(2002): 20-24.

Biernbaum, John. "Student and New Farmer Education to Support the Growth of Organic Farming. Crop Management." *Symposium Proceedings Organic Agriculture: Innovations in Organic Marketing, Technology And Research*. N.p., Oct. 2005. 1 Nov. 2012. <http://plantmanagementnetwork.org/pub/cm/symposium/organics/Biernbaum/.>.

Biernbaum, John, L. Thorp, and M. Ngouajio. "Development of a Year-round Student Organic Farm and Organic Farming Curriculum at Michigan State University." *HortTechnology* 16.3 (2006): 432-436.

Bradley, L.K. and Baldwin, K. “How to Organize an Allotment Community Garden.” AG-727W. *North Carolina Cooperative Extension* (2011): 17 p. <http://cals.ncsu.edu/hort_sci/extension/documents/ag-727.pdf>.

Clark, Sean and Laura Sayre, eds. *Fields of Learning: The Student Farm Movement in North America.* Lexington, Kentucky: The University Press of Kentucky, (2011).

Delate, K. "Incorporating Organic and Agroecological Approaches into the University Curricula: The Iowa State University Graduate Program in Sustainable Agriculture." *HortTechnology* 16.3 (2006): 445-448.

Dillman, D. A. *Mail and Internet Surveys: The Tailored Design Method.* 2nd ed. New York: Jon Wiley & Sons, (2000): 464 p.

Draper, C, and D Freedman. "Review and Analysis of the Benefits, Purposes, and Motivations Associated with Community Gardening in the United States." *Journal of Community Practice* 18.4 (2010): 458-492.

Grabau, L.J. "Teaching and Learning in Agronomy: One Hundred Years of Peer Reviewed Conversations." *Journal of Agronomy* 100(2008): 108-116.

Feenstra, G., Haresty, S., Allen, P, Perez, J. "Building Local Food Programs on College Campus." UC Davis Department of Agricultural Resource Economics and UC Santa Cruz Center for Agroecology and Sustainable Food Systems publication. (2008): 1-20.

Likert, R. "A Technique for the Measurement of Attitudes." *Archives of Psychology* 140(1932): 1-55.

Markhart, H. A. "Organic Educational Opportunities at the University of Minnesota: the Role of a Student-run Organic Farm." *HortTechnology* 16.3 (2006): 443-445.

McInturff, S. "The Delphi Method." *Forecasting and Futurism Newsletter* 1 (2009): 10-15. 5 Nov. 2012. < http://www.soa.org/library/newsletters/forecasting-futurism/september/ffn-2009-iss1.pdf.>

Ngouajio, M., Delate, K., Carey, E., Azarenko, A.N., Ferguson, J.J., and Sciarappa, W.J. "Curriculum Development for Organic Horticulture: Introduction." *HortTechnology* 16.3 (2006): 413-417.

Parr, D., Trexler, C.J., Khanna, N.R., Battisti, B.T. "Designing Sustainable Agriculture Education: Academics' Suggestions for an Undergraduate Curriculum at a Land Grant University." *Agriculture and Human Values* 24(2007): 523-533.

Parr, Damian, and C. Trexler. "Students' Experiential Learning and Use of Student Farms in Sustainable Agriculture Education." *Journal of Natural Resources & Life Sciences Education* 40(2011): 172-180.

Parr, D. and M. Van Horn. "Development of Organic and Sustainable Agricultural Education at the University of California, Davis: A Closer Look at Practice and Theory." *HortTechnology* 16.3 (2006): 426-431.

Pawelek, J. C., G. W. Frankie, R. W. Thorp, and M. Przybylski. "Modification of a Community Garden to Attract Native Bee Pollinators in Urban San Luis Obispo, California." *Cities and the Environment* 2.1 (2009): 2-15.

Perez, J., D. Parr, and L. Beckett. "Achieving Program Goals? An Evaluation of Two Decades of the Apprenticeship in Ecological Horticulture at the University of California, Santa Cruz." *Journal of Agriculture, Food Systems, and Community Development* 1.1 (2010): 107-124.

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J.A., and J.S. Litt. 2009. "Collective Efficacy in Denver, Colorado: Strengthening Neighborhoods and Health Through Community Gardens." *Health & Place* 15(2009): 1115-1122.

II. Challenges and Opportunities in Developing the Student Farm as an Educational Resource: A Nationwide Delphi Study on Student Farms

Abstract

With the growing number of sustainable agriculture education programs nationwide, much of the inquiry-based educational activities are centered on student farms. Although the number of college and university student farms is increasing, little is known about specific developmental, educational, and managerial aspects of these facilities. The purpose of this study was to identify key components to the development, management, and educational strategies that are common among student farms nationwide. Student farm leaders from 24 prominent colleges and universities throughout the U.S. were surveyed through a three-round online Delphi survey method process. Student farm leaders shared their expertise through their responses to ten survey questions focused on identifying characteristics of a successful student farm, educational and outreach activities for students and community groups, current funding strategies, and common challenges, issues and solutions on student farms. A total of 265 distinct responses were generated from the 10-question survey. In a subsequent round, participants were asked to rate those responses using a Likert scale. Results indicated the presence of a full-time farm manager, use of experiential and interdisciplinary learning techniques, and demonstration of the student farm as a viable asset to the institution were very important to the development and long-term management of the student farm among survey participants. Common challenges identified by participants included the lack of constant funding and administrative support and farm recognition throughout the college/university. Results from this study can help shed light on many of the successful components and challenges among leading student farms across the country which can be useful for student farms in the initial development, as well as established student farms. We

also hope results from this study can facilitate a new network of communication and collaboration among student farms nationwide.

Introduction

Recently there has been a tremendous increase of student interest in sustainable agriculture education (SAE) nationwide. Feenstra, Hardesty, Allen, and Perez (2008) reported that 62% of students surveyed at the University of California Davis and University of California Santa Cruz expressed interest in food production via sustainable methods. Many institutions are responding to this student demand with formal SAE academic programs now recognized in over 100 colleges/universities nationwide (Parr, 2011). Sustainable agriculture education programs are typically characterized by a highly multidisciplinary curriculum, in-field and experiential learning opportunities, and student/farmer training programs (Parr, Trexler, Khanna, and Battisti, 2007; Ngouajio, Delate, Carey, Azarenko, Ferguson, and Sciarappa, 2006). Moreover, many of these hands-on educational activites occur on student farms, which have been instrumental in supporting the growth of SAE on campuses nationwide (Parr et al., 2007; Ngouajio et al., 2006).

The Sustainable Agriculture Education Association (http://www.sustainableaged.org/) reports there at least 40 student farms located on various colleges and universities nationwide. These student farms are critical facilities to help train future producers and educate food-system leaders. Some of the various educational activities that occur on student farms include student apprenticeships, internships, employment opportunities, as well as future-farmer training programs. Through these hands-on experiences, students gain diverse benefits including experience in sustainable agriculture production and marketing, research, outreach and professional development. However, despite the benefits derived from student

farms, there is currently a lack of focused research on student farms as key components of sustainable agriculture education. Many student farms focus solely on production-based educational activities and often times are left with insufficient time and resources to implement additional educational activities and lessons. Therefore, research devoted to identifying educational and outreach activities, current successes, challenges, and the solutions to address those issues can serve as a vital resource to newly developing student farms, as well as those already established. Components identified from this research can also aid in student farm design and development, as well as further highlight the role of student farms in sustainable agriculture education (SAE).

Similar to the increase of student farms, the establishment of community gardens nationwide has also been growing. A reported one million households in the U.S. utilize community gardens, while an additional five million households have expressed interest in constructing community gardens (Pawelek, Frankie, Thorp, and Przybylski, 2009). Community gardens are diverse in focus and can and include urban gardens, faith-based gardens, school gardens, and entrepreneurial/market gardens (Baldwin, Beth, Bradley, Davé, Jakes, and Nelson, 2009). Similar to student farms, community gardens can also offer a diversity of benefits to individuals such as leadership opportunities, enhanced food security, civic engagement, community building, and educational opportunities (Teig, Amulya, Bardwell, Buchenau, Marshall, and Litt, 2009). A recent review of community gardens nationwide highlighted common benefits including increased physical and mental health, economic development, social interaction, cultivation of relationships, and community organization (Draper and Freedman, 2010).

Unfortunately, despite the numerous benefits of community gardens, many community gardens are established, but then fail due to various complications. Commonly experienced complications from which community gardens suffer include lack of infrastructure, funding, and information concerning sustainable agriculture practices. Additionally, Pawelek et al. (2009) explain a divide and disconnect between university-level research and technical information in sustainable agriculture and community gardens. Simultaneously, many student farms focus primarily on sustainable agriculture production education for students, but lack focused community engagement activites outside of marketing opportunties. Many student farms may not interact at all with surrounding community gardens, thus further deepening a perhaps already existing divide between students and surrounding community members. The interaction between student farms and the surrounding community can be enhanced to be mutually beneficial through increased engagement, the fostering of strengthened relationships, information dissemination, enhanced communication skills, as well as access to cutting edge technology and college/university resources.

Recent research has highlighted some of the shared perspectives and benefits of sustainable agriculture education (SAE) on student farms. Parr and Trexler (2011) performed a focus-group study with students from three geographically unique student farms to identify perspectives on effective learning approaches in SAE and how their experiences on student farms were integrated into their formal educational programs. Research showed that second to students identifying the importance of combining integrated theory and practice between their class work and fieldwork, the next most effective learning approach identified was the benefit of learner-centered social engagements that emphasized peer-to-

peer learning opportunities. From the results in this study, they stressed the increased need for student farm community outreach and involvement (Parr and Trexler, 2011).

The research in this study examines key components to the successful establishment and development of student farms nationwide. We specifically aimed to identify student farms that strategically integrate community involvement into the managerial and educational focus of the student farm. We used a Delphi survey methodology (McInturff, 2009; Dillman, 2000) to examine 24 student farm programs from various colleges and universities across the country. The perspectives of student farm managers and administrative/faculty positions were solicited for: student farm development; management; educational and outreach strategies; current struggles and challenges; the solutions to those; and finally, future educational and outreach activities possible for student farms. The results from this research can be instrumental in identifying key components to the successful day-to-day operation of student farms, as well as specifically targeting educational and outreach strategies that help foster community engagement on student farms.

Materials and Methods

Delphi Study Design

A Delphi study survey methodology was used to examine the experiences and perspectives from various leaders of student farms nationwide. The Delphi methodology allows for the systematic collection, aggregation and consensus of informed perspectives from a group of experts on specific questions and issues (Dillman, 2000). Specifically, this study involved three rounds of questioning via an online survey.

The first survey, or first round of questioning, was used to develop a large comprehensive list of responses to ten questions that examined participants' perspectives on

successful farm management and establishment; student and community educational strategies; funding strategies; challenges and solutions; and future ideas for student farms (Table 2.1). The second round of questioning consisted of coding and collating the previous round's responses, then resubmitting all answers back to each participant. The participants were then allowed to review the first round of responses from all participants and had seven weeks to revise any previously made statements or add new responses to the list. After the second round was complete, a final comprehensive list of responses was generated and participants were once again presented with the comprehensive answer set. Then in the third and final round of the survey process, participants were asked to rate the importance and/or relevance of each particular response. A simple predetermined Likert scale (Likert, 1932) of 1-5 was used to rate each of the responses from the answers to each question (Table 2.1). This psychometric response scale is commonly used in questionnaires to obtain participant preference or degree of agreement with a statement or set of statements (Bertram, 2012). The entire survey process (Rounds 1, 2, and 3) was conducted from March 27 to July 23, 2012.

Target Audience Selection Process

In order to represent the regional diversity of U.S. student farms, we aimed to include a wide variety of colleges and universities in our target audience. The list of student farms and their representative contacts were gathered from the Sustainable Agriculture Education Association Student Farm Directory (http://sustainableaged.org/Resources/StudentFarmDirectory/tabid/85/Default.aspx), and suggestions from the thesis advisory committee. A total of 34 student farms were contacted to participate in the study and represented a diversity of private and public colleges, land-

grant universities, and community colleges spanning 23 states nationwide (Table 2.2, Figure 2.1).

Survey Development and Distribution Process

Given the objective of developing a new student farm at North Carolina State University (NCSU), input from the current thesis advisory committee focused on five categories of information for the survey which included: 1.) Defining management, establishment, and successful components of student farms; 2.) Student and community education and outreach strategies; 3.) Current challenges and issues commonly faced on student farms; 4.) Funding resources; and 5.) Future educational opportunities for students and community on student farms. From these categories, a series of ten survey questions was developed (Table 2.1). North Carolina State University's College of Agriculture and Life Sciences Survey Builder program was used to create the online surveys and was used throughout the entirety of the three-round survey process.

The NCSU Institutional Review Board (IRB) for the Protection of Human Subjects in Research approved the survey March 2, 2012, prior to the initial survey distribution to the participants. For IRB approval, it was imperative to state within the survey directions that the study was completely voluntary, no personal information would be shared and anonymity would be upheld throughout the entire survey process. For this reason, we will not identify any particular student farm program or individual that was involved with the study.

After IRB approval was granted and the initial survey was complete and ready for dissemination, each student farm leadership team (farm manager(s), and faculty or administrator overseeing the farm) received an email invitation to participate in this study on March 27, 2012. If the participants chose to take place in the study, they were provided a

link to the first round of the survey through the email invitation. All participants were phoned and re-sent email invitations until personal contact was made to answer any questions regarding the study and elicit additional participation over the following two weeks. Participants were asked to complete the first round of the survey within six weeks, and were emailed approximately 14, seven, and three days prior to the first round survey's end date (May 14, 2012). After the conclusion of the first survey, roughly one week was allowed to collect and collate all responses, and then generate the second survey.

The second round of questioning took place from May 21 to June 6, 2012. In this round, participants were provided with the comprehensive answer list from the previous round's questions. The participants were then instructed to review the responses and edit or add any additional information to the previous answer set. The same follow-up processes were used for this round as the first. All participants were individually emailed, provided the link and directions to the second round survey, and repeatedly sent follow-up emails as reminders to complete the survey during the two-week completion window. The third and final survey was disseminated on June 22, 2012. In this round, participants were provided with the comprehensive answer list from the previous two rounds, and were instructed to rate those responses given the Likert scale provided (Table 2.1). This third and final round was concluded on July 23, 2012. The same follow-up and reminder processes were used during the third round as the previous two.

Student Farm Participation, Data Collection, and Analysis

Initially, 53 individuals from 34 student farm programs were invited to participate in the study. Minor attrition took place during the study. Some initially contacted participants did not choose to participate in the study, in addition other programs never responded to the

initial invitation and phone calls. Ten programs, a total of 16 individuals, dropped out between the start of round one and the end of round three.

Data were collected and analyzed using the CALS Survey Builder program and then transferred into Microsoft Excel (Excel 2007, Version 12.3.6) for data analysis. All responses from the first round were received, collated, and each individual response was given numerical identity to protect anonymity. The same process was used during the second round, where a larger response list was generated. In the third and final round, the participants were asked to rate the responses using a predetermined Likert scale for every question (Table 2.1). The ten top rated responses to each question were graphed and descriptive statistics (mean and standard deviation) were calculated for each qualitative response to the survey questions in effort to generate a shared consensus among participants. No additional statistical analyses were conducted in this study, as the metrics of means and standard deviations were determined most appropriate to use when analyzing the qualitative responses.

Results

Delphi Study Overall Participation and Response Rate

Through the two rounds of questioning, a total of 265 responses were generated from the ten survey questions (Appendices A-J). Each question generated at least 17 responses (mean = 27, maximum = 40). Response rates to the surveys dropped from rounds one to two, but remained the same from rounds two to three. A total of 24 out of 53 possible individuals (45%) participated in round one of the study. During the second and third rounds, 20 out of 37 possible participants (54%) participated in the study. Over all three rounds of the Delphi

study from March 27, 2012 through July 23, 2012, we achieved a 51% participant response rate.

Defining Successful Management, Establishment, and Components of Student Farms

The first three questions aimed to have student farm leaders define the successful establishment, management, and components of student farms. Results demonstrate three of the ten highest rated characteristics of successful student farms were focused on educational components including experiential learning, educationally focused farms, and hands on technical training (Figure 2.2). Three additional top ten responses identified the importance of support staff, a full-time farm manager and competent staff who are welcoming, appreciated and loved by many. Additional successful student farm management strategies included demonstrating sustainable agriculture practices, having a steady source of financial funding, and being well organized.

In question two, highly rated responses for the successful establishment of student farms identified the importance of a full-time and experienced farm manager, an initial startup budget, as well as land acquisition and tenure (Appendix B). All top ten rated responses were all rated at least "important," with many nearing the top of the scale, "very important." Top rated responses for the long-term management of successful student farms (question three) again included the importance of maintaining an experienced and dedicated farm manager and staff. Other top rated responses included administrative and faculty support, effective communication and an enthusiastic attitude (Appendix C). Participants highly rated the importance of students feeling a sense of ownership and importance at the farm. Responses to this question specifically addressed long-term management aspects that would take place on the student farm but also throughout the farm's administration and

faculty involvement at the institution. A total of 100 responses were generated and rated between the survey's first three questions.

Student and Community Engagement and Education Strategies

In question four, survey participants identified student internships and opportunities to use farm equipment as two of the top ten rated educational and outreach strategies for college/university students (Figure 2.3). These responses are similar to responses observed in question one where experiential learning was identified as a highly important component to a successful student farm. Additionally, another highly rated response for educational strategies with students was activities that focused on interdisciplinary learning. Both interdisciplinary undergraduate and graduate courses involved with the farm, as well as interdisciplinary lecturers were rated above 4.0. Other highly rated responses included the success of student involvement with community tours and events, and student participation in CSA programs (Figure 2.3).

In parallel to student educational and outreach activities, survey participants also identified successful strategies for community members in question five. One of the top ten highest rated successful strategies identified for community education was a community supported agriculture (CSA) program (Figure 2.4). Additional top rated community outreach strategies included hosting tours for the general community, as well for homeschool and K-12 children. Similar to the successfully rated student strategies, hosting guest speakers (both agriculturally related and interdisciplinary) was rated as a successful strategy. Additional top rated community educational strategies included hosting farmer training programs, volunteer workdays, and making connections with local non-profit organizations (Figure 2.4).

Funding Resources

Demonstration of the farm as a viable asset to the college/university was rated as one of the top funding strategies (Figure 2.5). Additionally important funding strategies identified were receiving institutional support, CSA programs, and market revenue and on-campus sales.

Challenges, Issues, and Solutions Implemented on Student Farms

The identification of current challenges and issues faced on student farms were assessed in questions seven and eight. It was not surprising that one of the top responses was securing constant funding for student farms (Figure 2.6). Other highly rated challenges included aspects involving farm staff and production. One interestingly highly rated challenge participants identified was being torn between production and educational focus on the farm. Participants also identified the challenges of maintaining enthusiasm and a positive attitude during difficult times, lack of institutional support, and the challenge of staff burnout (Figure 2.6).

Question eight of the survey aimed to identify the greatest issues comonly observed on student farms. While the challenges identified in question seven may occur on a daily basis in a season, we aimed to identify issues as larger on-going problems occuring on student farms. Some of the top issues identified by student farm leaders were continuous funding, lack of time, and sustaining full institutional support (Appendix H). Many of these additionally highly rated issues identified lack of teamwork and an organized chain of command, as well as lack of faculty competent in both agriculture and social sciences.

In question nine, survey particpants identified the most practical solutions to commonly observed challenges and issues on student farms described in questions seven and eight. One of the highly rated solutions was the presence of an experienced farm manager

(Figure 2.7). The importance of strong communication, establishing a positive relationship with administrative suport within the home department, and clearly communicating between the farm staff and its students were also highly rated from participants. Additional solutions to current challenges and issues were included securing constant funding and maintainting positive faculty and administrative support.

Future Educational and Outreach Activities on Student Farms

In response to question ten, participants generated a wide variety of diverse ideas and future educational and outreach activities that can occur on student farms (Appendix J). One of the highly rated responses included having undergraduate and graduate courses taught on the farm. Additional future ideas for student farms included providing a diversity of on-farm lessons, implementing dining hall programs, as well as working with food bank donation programs.

Discussion

The purpose of this study survey was to identify successful aspects of student farm development, management, and various educational strategies from student farm leaders nationwide. Survey questions were designed to highlight current educational strategies taking place on student farms nationwide focused on both students and the surrounding community. Two hundred and sixty five responses were received from various farm managers and faculty/administrative personnel representing 24 student farms across the country. Through the use of the Delphi survey methodology in this study, we were able to describe shared commonalities and consensus among student farm leaders nationwide. It is clear, however, that there is no consensus on any one perfect approach, but rather diverse

perspectives and lessons learned that highlight current challenges, issues, strategies, and activities successfully implemented on student farms throughout the U.S.

It was not surprising that the importance of a full-time farm manager and competent staff was rated very highly among student farm leaders when identifying both successful characteristics in the establishment and the long-term management of student farms. Student farm managers and staff must be skilled in sustainable production knowledge, as well as educating and communicating with diverse audiences. Faculty at the University of California (UC) Davis quickly identified the need for a farm manager during the beginning years of the UC Davis Student Experiential Farm (SEF) (Parr and Van Horn, 2006). A full-time farm manager, as well as additional part-time farm staff member positions was created in order to meet the growing needs of coordinating efforts between the UC Davis SEF students and staff, as well as maintain the program's facilities and equipment (Parr and Van Horn, 2006). Biernbaum (2011) also stressed the importance of hiring a capable farm manager that also possesses passion and commitment for experiential learning and group dynamics.

Student farm leaders also highly rated the importance of experiential learning, as well as clear demonstration of sustainable agriculture practices, as successful components to the establishment and long-term management of the student farm. The focus on experiential learning in sustainable agriculture education (SAE) has been emphasized as a shared pedagogical strategy across various sustainable agriculture programs. In a Delphi survey among 17 North American colleges and universities, Parr, Trexler, Khanna, and Battisti (2007) found that experiential learning was rated the second most important teaching approach as identified by social science, humanities and natural science academics. Van Horn (2011) and Slotnick (2011) also stressed the importance of experiential learning on

student farms as a component that can be integrated in curriculum through internships and additional hands-on production experiences.

Students' sense of ownership and importance was a highly rated component of successful student farms. Trexler, Parr, and Khanna (2006) found that practical experiences, allowance for student governance, as well as providing student opportunities to conduct financial and potential crop budgets were all highly rated responses from various agricultural practitioners nationwide. Allowing more experienced students to make everyday managerial decisions and have apprentice-type roles with the farm manager can provide lateral mentoring opportunities for less experienced students, as well as increase students' exposure to the complexities of farm management and sustainable agriculture. Survey participants also identified the importance student internships and students practicing with farm equipment as successful educational strategies on student farms. The experiential learning focus identified here is echoed from a similar Delphi study where Trexler, Parr and Khanna (2006) identified student internships as very important on-farm experiences for students in SAE curriculum. This was also found in a review paper where nine universities identified major experiential training to be common among organic and SAE curricula (Ngouajio, Delate, Carey, Azarenko, Ferguson, and Sciarappa, 2006). Ultimately, through employing a dedicated and knowledgeable staff and implementing self-empowering and experiential learning experiences, students can gain numerous skills as future food system leaders from student farms.

Multidisciplinary learning and systems level thinking are found to be shared characteristics of SAE programs, and not surprisingly, was also indentified as important on student farms in this study. Agriculture, environmental, and social sciences have been

described as key disciplines integrated in sustainable agriculture education programs (Ngouajio et al., 2006; Parr and Van Horn, 2006; Trexler, Parr and Khanna, 2006). Strategically integrating natural and social science knowledge, skills, and understanding through interdisciplinary coursework is essential to comprehend the concept of sustainability, all of which are possible through activities on student farms (Parr and Van Horn, 2006). In this study, student farm leaders identified strategies for multidisciplinary education on student farms through engaging diverse guest lecturers (both agriculturally-related and interdisciplinary), community supported agriculture (CSA) programs, community tours and events, and conducting graduate and undergraduate research projects. Incorporating these multidisciplinary learning experiences on student farms will not only enhance students' agricultural production skills, but can also provide opportunities to enhance personal and professional development.

While community engagement and education strategies are not typically emphasized on student farms, we believe this may be an innovative component that can provide duel benefits to students and the surrounding community. For that reason, we included survey questions that targeted strategies that specifically engaged the surrounding community. While the educational focus of student farms is clearly on students, many student farms do actively engage various community groups and individuals (Biernbaum, 2011; Kohanowich, 2011; Slotnick, 2011; Van Horn, 2011). When student farm leaders were asked about successful strategies for engaging community, CSA programs and hosting volunteer work days were among the top rated answers. Community supported agriculture programs are common within various college/university sustainable agriculture education programs and student farms (Ngouajio et al., 2006), as they provide multiple educational opportunities for

students in marketing and generate revenue for the student farm. Community supported agriculture programs can integrate students with community and campus consumers and provide opportunities for students to develop communication and organization skills, as well as recognize the importance of a contractual agreement between the student farm and outside parties (Slotnick, 2011). In research used to develop UC Davis's Student Experimental Farm (SEF), Parr and Van Horn (2006) were able to identify community projects and activities that were originally developed in the late 1970's. They found that apprenticeship programs, as well as market garden and field day workshops, were common university sponsored projects and events for community groups, many of which were local farmers desiring to partner with the UC Davis SEF.

Survey results from this study also identified the importance of farmer training programs, volunteer workdays, and general community and education workshops hosted by the farm staff. Additional community educational and outreach strategies were identified as hosting multidisciplinary speakers, collaborating with local non-profit organizations, and conducting farmers markets and plant sales. Although this study identified numerous educational and outreach strategies for community groups, the importance of engaging community on student farms can go beyond simply a marketing approach. Student farms provide unique opportunities for students and community to share sustainable agriculture knowledge, but also further engage in societal learning exchanges. An example of this community educational engagement with student farms is demonstrated at the University of Montana's Program in Ecological Agriculture and Society Farm (PEAS). Through time, the PEAS program has developed a "Community Education" program which hosts thousands of children ever year on field trips, as well as multiple educational camps and classes hosted at

the farm. The PEAS farm has also worked in unison with a local community program called Garden City Harvest, where the PEAS farm hosts a small group of kids from Missoula, Montana's Youth Drug Court, as well as provides fifteen to twenty thousand pounds of food annually to a local food bank for impoverished families (Slotnick, 2011). The PEAS farm's community outreach goes beyond the thousands of children they educate each year, by also successfully operating a ninety-member CSA program. There are numerous untapped opportunities for community engagement on student farms and opportunities that have potential for going beyond the scope of sustainable agriculture education, but further rooting the student farm as an integral piece into the community.

Although the formal literature is scarce, it is recognized that many student farm programs must self-finance their operations. Therefore, the importance of having a strong revenue-generating system in place is vital to the success of the student farm program. When student farm leaders were asked about successful funding strategies for student farms, one of the top-rated strategies identified was demonstrating the farm as a viable asset for the institution. Because student farms often operate as student or faculty-run components of college/university SAE programs, it is important for the student farm to engage institution administrators and campus leaders, and effectively communicate their efforts into the outside community. As an example of this, Bettman (2011) described how the University of Oregon's Urban Farm received institutional funding support from the Landscape Architecture Department, as well as foundational funding from a generous donor in the Seattle area who's greatly interested in the university's Urban Farm. Interestingly, the University of Oregon's Urban Farm is also the only student farm offered by a Landscape Architecture Department in the country (Bettman, 2011), and further serves as an innovative

model that successfully receives sufficient funding from both advocates of the student farm within the institution, as well as from the community.

Not surprising, financial capital (startup budget) was also identified as important, as well as acquiring land, maintaining agricultural and technical proficiency, and employing both a competent and committed farm staff. However, current challenges identified by student farm leaders included the lack of administrative and institutional support, which in fact could be linked to staff burnout. Furthermore, the challenge of farm visibility (college/university wide) is important to consider, as we previously observed the importance of demonstrating the farm as an asset to the institution.

In addition to the everyday or perhaps seasonal challenges that a student farm may face, there are also larger on-going issues commonplace on student farms. An interesting and highly rated issue identified was the difficulty of balancing the production focus and the educational focus on student farms. As previously described, many student farm programs rely upon farmers markets and CSA programs to financially sustain their operations. Therefore, responsibility for the student farm to meet these contractual obligations can at times sacrifice a teachable/educational moment in order to meet the production demands (Slotnick, 2011). This can prove difficult for student farm, as it is defined as a campus educational facility that provides hands-on opportunities for students (Parr and Trexler, 2011), but it must also successfully meet the demands of any CSA and food contracts that provide the economic viability of the operation. Further issues were identified around student and personnel complications; however, ultimately a diverse and experienced faculty and staff competent in sustainable agriculture, as well as business management,

communications, and other disciplines can prove vital to the success of the student farm (Crews, 2011).

Perhaps one of the most interesting findings from this study came from student farm leaders identifying solutions that address the challenges and issues described above. The presence of an experienced farm manger was identified as one of the most important solutions. The need for a competent farm manager was also emphasized by the experiences from the New Mexico State University student farm; a farm that likely would never have been established without a highly organized and hardworking farm manager (Falk, 2011). The importance of employing experienced and dedicated personnel is continually identified as important to the success of the student farm, and we further suggest the need to also properly train, pay and maintain these crucial student farm management teams. Student farm leaders also identified the importance of establishing a positive relationship with administrative support from the home department (i.e. the overarching supportive entity within the college/university). This response, also combined with securing institutional support and constant funding, were all identified as additional important solutions. Therefore, strongly enhancing the relationship between the student farm and institution can only benefit both parties, as the student farm can operate as a viable asset within the institution, as well as to the outside community.

Our last question aimed to gather ideas for future student farm innovations from nationwide experienced student farm leaders. The responses were diverse ranging from undergraduate and graduate courses specifically taught on the farm, to dining hall programs, as well as implementing innovative on-farm energy projects and subject-specific demonstration areas. Serving as a model of this, The Michigan State University Student

Organic Farm started as an area designed for organic high-tunnel research, but quickly expanded to a thriving forty-eight week community supported agriculture (CSA) program that provided students and outside community members with ample opportunities and experiences in organic farming (Biernbaum, 2011). This may suggest however diverse the educational and outreach strategies implemented on student farms may be, the goal of creating an innovative operation that integrates campus and community can be very successful and identified at its inception. Therefore, ultimately for student farms to advance learning and create communal relationships focused on sustainable agriculture, innovative development plans, the need for pushing the boundary of what is possible on student farms, and increasing communication and collaboration efforts among nationwide student farm leaders is essential.

In conclusion, the results from this study demonstrated numerous shared components of student farm development, management, educational, and problem-solving strategies implemented on student farms today. We hope results from this research will serve as a guide to identify some of the commonplace themes on student farms and help define important factors that will help continue the growth of student farms in the future. Ultimately, a student farm that strategically engages community members in educational and outreach opportunities can effectively increase the overall learning experience and community interaction for the student, and also in return act as a vital educational resource to the local community. The increased interaction between college/student farms and the local community can in turn help enhance the community's affinity and relationship with the farm and students, and effectively meet the needs previously identified for increasing sustainable agriculture education. Finally, we hope this study can also emphasize the need for enhanced

communication and collaboration among student farms, facilities that can provide powerful experiential learning opportunities and help advance sustainable agriculture education nationwide.

REFERENCES

Bagdonis, J. M., C. C. Hinrichs, and K. A. Schafft. "The Emergence of Framing Farm to School Initiatives: Civic Engagement, Health and Local Agriculture." *Agriculture and Human Values* 26(2009): 109-117.

Baldwin, K., Beth, D., Bradley, L.K., Davé, N., Jakes, S., Nelson, M. 2009. "Eat Smart, Move More North Carolina: Growing Communities through Gardens." *N.C. Department of Health and Human Services, Division of Public Health*. Raleigh, NC; (2009).

Bertram, D. "Likert Scales – Are the Meaning of Life." CPSC 681 – Topic Report (2012): 1-10. 5 Nov. 2012 <http://www.poincare.matf.bg.ac.rs/~kristina//topic-dane-likert.pdf.>

Bettman, A. "University of Oregon (1976): Designing for Change." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 109-128.

Bhavsar, V M. "Certified Organic Farming Principles and Practices: a Course Linking Farmers and University Students." *Journal of Natural Resources* 31(2002): 20-24.

Biernbaum, J. "Michigan State University (2003): Four-Season Student Farming." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 289-305.

Biernbaum, John. "Student and New Farmer Education to Support the Growth of Organic Farming. Crop Management." *Symposium Proceedings Organic Agriculture: Innovations In Organic Marketing, Technology And Research*. N.p., Oct. 2005.1 Nov.

2012.
<http://plantmanagementnetwork.org/pub/cm/symposium/organics/Biernbaum/>.

Biernbaum, John, L. Thorp, and M. Ngouajio. "Development of a Year-round Student Organic Farm and Organic Farming Curriculum at Michigan State University." *HortTechnology* 16.3 (2006): 432-436.

Bradley, L.K. and Baldwin, K. "How to Organize an Allotment Community Garden." AG-727W. *North Carolina Cooperative Extension* (2011): 17 p. <http://cals.ncsu.edu/hort_sci/extension/documents/ag-727.pdf>.

Clark, Sean and Laura Sayre, eds. *Fields of Learning: The Student Farm Movement in North America.* Lexington, Kentucky: The University Press of Kentucky, 2011.

Crews, T. "Prescott College (1996): Agroecology as the Cultivation of Soil and Mind." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 209-226.

Delate, K. "Incorporating Organic and Agroecological Approaches into the University Curricula: the Iowa State University Graduate Program in Sustainable Agriculture." *HortTechnology* 16.3 (2006): 445-448.

Dillman, D. A. *Mail and Internet Surveys: The Tailored Design Method.* 2nd ed. New York: Jon Wiley & Sons, (2000): 464 p.

Draper, C, and D Freedman. "Review and Analysis of the Benefits, Purposes, and Motivations Associated with Community Gardening in the United States." *Journal of Community Practice* 18.4 (2010): 458-492.

Falk, L. C., and Pao, P. “New Mexico State University (2002): Planting an OASIS.” *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 269-288.

Feenstra, G., Haresty, S., Allen, P, Perez, J. “Building Local Food Programs on College Campus.” UC Davis Department of Agricultural Resource Economics and UC Santa Cruz Center for Agroecology and Sustainable Food Systems publication. (2008): 1-20.

Grabau, L.J. "Teaching and Learning in Agronomy: One Hundred Years of Peer Reviewed Conversations." *Journal of Agronomy* 100(2008): 108-116.

Kohanowich, R. “Central Carolina Community College (1995): Growing New Farmers.” *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 192-208.

Kolb, D.A. “Experiential Learning: Experience as the Source of Learning and Development.” Englewood Cliffs, New Jersey: Prentice Hall, 1984. 1-22.

Likert, R. "A Technique for the Measurement of Attitudes." *Archives of Psychology* 140(1932): 1-55.

Markhart, H. A. "Organic Educational Opportunities at the University of Minnesota: the Role of a Student-run Organic Farm." *HortTechnology* 16.3 (2006): 443-445.

McInturff, S. “The Delphi Method.” *Forecasting and Futurism Newsletter* 1 (2009): 10-15. 5 Nov. 2012. < http://www.soa.org/library/newsletters/forecasting-futurism/september/ffn-2009-iss1.pdf>.

National Research Council. “Colleges of Agriculture at the Land Grant Universities: Public Service and Public Policy.” Committee on the Future of Colleges of Agriculture in

the Land Grant University Research System, National Research Council. National Academy. Press, Washington, D.C. (1996).

National Research Council. "Colleges of Agriculture at the Land Grant universities: Public Service and Public Policy." Washington, DC: National Academy Press. 29(1996).

Ngouajio, M., Delate, K., Carey, E., Azarenko, A.N., Ferguson, J.J., and Sciarappa, W.J. "Curriculum Development for Organic Horticulture: Introduction." *HortTechnology* 16.3 (2006): 413-417.

North Carolina State University College of Agriculture and Life Sciences Survey Builder. 18 Mar. 2012, concluded 20 July 2012. <http://harvest.cals.ncsu.edu/applications/calswebsite/websitebuilder2/>

Parr, D., Trexler, C.J., Khanna, N.R., Battisti, B.T. "Designing Sustainable Agriculture Education: Academics' Suggestions for an Undergraduate Curriculum at a Land Grant University." *Agriculture and Human Values* 24 (2007): 523-533.

Parr, D. "Student Farmer to Student Farmer: Transformational Learning in Sustainable Agriculture and Food Systems Education." Diss. University of California Santa Cruz, Santa Cruz, 2009.

Parr, D. "Sustainable Agriculture Education Association: Student Farm Directory." (2011) 1 Mar. 2012 <http://sustainableaged.org/Resources/StudentFarmDirectory/tabid/85/Default.aspx>.

Parr, Damian, and C. Trexler. "Students' Experiential Learning and Use of Student Farms in Sustainable Agriculture Education." *Journal of Natural Resources & Life Sciences Education* 40(2011): 172-180.

Parr, Damian, and M. Van Horn. "Development of Organic and Sustainable Agricultural

Education at the University of California, Davis: A Closer Look at Practice and Theory." *HortTechnology* 16.3 (2006): 426-431.

Pawelek, J. C., G. W. Frankie, R. W. Thorp, and M. Przybylski. "Modification of a Community Garden to Attract Native Bee Pollinators in Urban San Luis Obispo, California." *Cities and the Environment* 2.1 (2009): 2-15.

Perez, J., D. Parr, and L. Beckett. "Achieving Program Goals? An Evaluation of Two Decades of the Apprenticeship in Ecological Horticulture at the University of California, Santa Cruz." *Journal of Agriculture, Food Systems, and Community Development* 1.1 (2010): 107-124.

Reid, N.G. "The Delphi Technique: It's Contribution to the Evaluation of Professional Practice." *Professional Competence and Quality Assurance in the Caring* Profession. Ed. E. Ellis. Croom Held, New York. 230–262.

SAEA. "Sustainable Agriculture Education Association, National Academic Programs List." (2012) 1 Mar. 2012 <http://sustainableaged.org/Resources/StudentFarmDirectory/tabid/85/Default.aspx>

Schroeder, M.S., Creamer, N.G., Linker, H.M., Mueller, J.P., and P. Rzewnicki. "Interdisciplinary and Multilevel Approach to Organic and Sustainable Agriculture Education at North Carolina State University." *HortTechnology* 16.3 (2006): 418-426.

Slotnick, J. "University of Montana (1997): Agriculturally Supported Community." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 227-245.

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J.A., and J.S. Litt. 2009.

"Collective Efficacy in Denver, Colorado: Strengthening Neighborhoods and Health Through Community Gardens." *Health & Place* 15(2009): 1115-1122.

Thompson, B. "Educational and Training Opportunities in Sustainable Agriculture Annual Report, 19th Edition." *National Agricultural Library: Agriculture Research Service, U.S. Department of Agriculture.* 2009.

Trexler, C., Parr, D., and N. Khanna. "A Delphi Study of Agricultural Practitioners' Opinions: Necessary Experiences for Inclusion in an Undergraduate Sustainable Agricultural Major." *Journal of Agricultural Education.* 47.4 (2006): 15-24.

"What is Sustainable Agriculture Overview?" *Sustainability Agriculture Research and Education Program: Agricultural Sustainability Institute at UC Davis*. University of California Davis, n.d. Web. 8 Oct. 2012. <http://sarep.ucdavis.edu/sarep/about/def>.

"Sustainable Agriculture: Information Access Tools." *United States Department of Agriculture Alternative Farming Systems Information Center*. United States Department of Agriculture National Agricultural Library, n.d. Web, 8 Oct. 2012. <http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml>.

Van Horn, M. "University of California, Davis (1977): Moving from the Margins toward the Center." *Fields of Learning*: *The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 129-148.

Table 2.1. Delphi survey questions and categories posed to participants in Rounds 1 and 2, and Likert scales used in Round 3.

Question Category	Questions	Scale(s) Used
1. Defining management, establishment, and successful components of student farms	1. Based on your experience, what are the characteristics of a successful student farm (Examples: financial institutional support, number of participating students, diversity of educational programs, yearly market revenue generated, etc.)?	Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)
	2. What components are necessary for the establishment of a new student farm (Examples: land, personnel, design, equipment, etc.)?	Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)
	3. What are the factors contributing to sustain the long-term management of a successful student farm?	Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)
2. Student and community education and outreach strategies	4. Based on your experience, what have been the most successful educational and outreach activities for university students on your farm (Examples: field trips, laboratories, student internships, etc.)?	Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5)
	5. Based on your experience, what have been the most successful educational and outreach activities for community members (e.g., K-12, volunteers, etc.) on your farm (Examples: workshops, demonstrations, farmer-training programs, etc.)?	Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5)

Continued next page…

Table 2.1. continued.

3. Funding Resources	6. What types of funding strategies have you used for a successful student farm?	Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)
4. Challenges, issues, and solutions implemented on student farms	7. From your experience, what do you perceive to be the greatest challenges for establishing and managing a successful student farm?	Not Challenging (1), Minimally Challenging (2), Somewhat Challenging (3), Challenging (4), Very Challenging (5);
	8. From your experience, what do you perceive to be the most significant issues for establishing and managing a successful student farm?	Not an Issue (1), Minimally an Issue (2), Somewhat an Issue (3), Issue (4), Very much an Issue (5)
	9. From your experience, what do you consider as practical alternatives for challenges and issues when managing a successful student farm?	Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)
5. Future educational and outreach activities on student farms	10. In addition to your current farm activities, what other types of educational and outreach activities do you feel are possible on student farms?	Not Possible (1), Minimally Possible (2), Somewhat Possible (3), Possible (4), Very Possible (5)

Table 2.2. Student farm program participants in Rounds 2-3 of Delphi study.

Type of Institution	Number of Participating Programs	Number of States Represented Nationwide
Community college	1	1 (NC[z])
Liberal arts college	6	6 (AZ, KY, NC[z], OR, PA[z], VT)
Land-grant university	10	10 (CA[z], FL, GA, IA, ID, MI, NJ, NM, PA[z], SC,)
Private research university	2	2 (CA[z], NC[z])
Public university (other)	5	4 (CA[z], MT, NC[z], WA)
	Total Number of Participating Programs	Total Number of States Represented Nationwide
	24	17

[z]States with more than one participating student farm program (CA, PA, and NC).

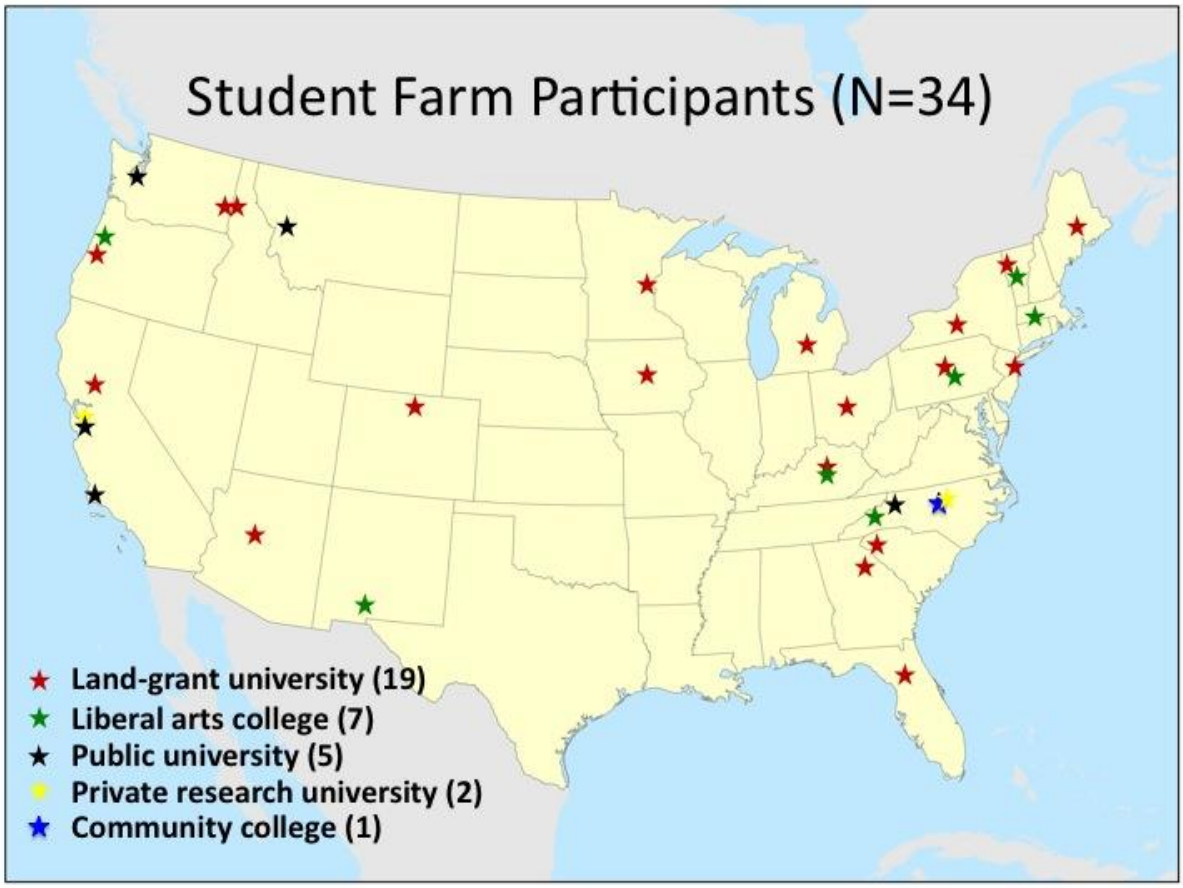

Figure 2.1. Map of college and university student farm programs contacted to participate in Delphi study (N=34).

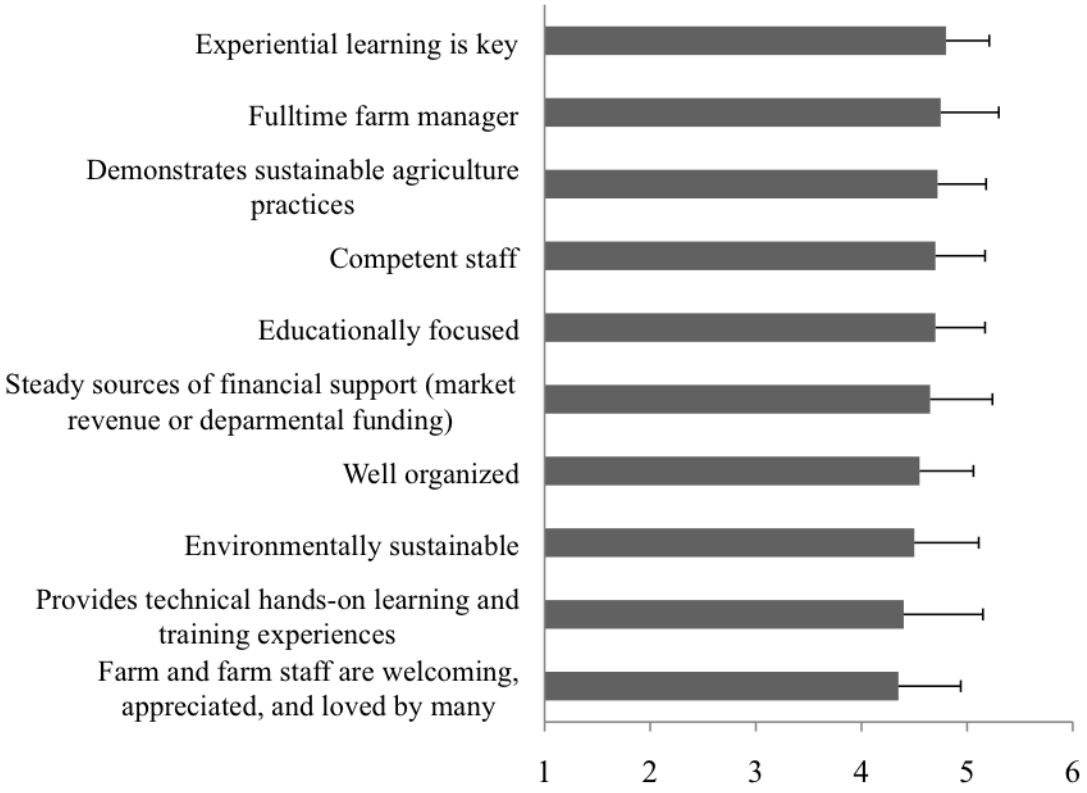

Figure 2.2. Highest ten rated characteristics (mean, +SD) of a successful student farm identified from Delphi survey participants (n=40 total responses generated for this question). Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5).

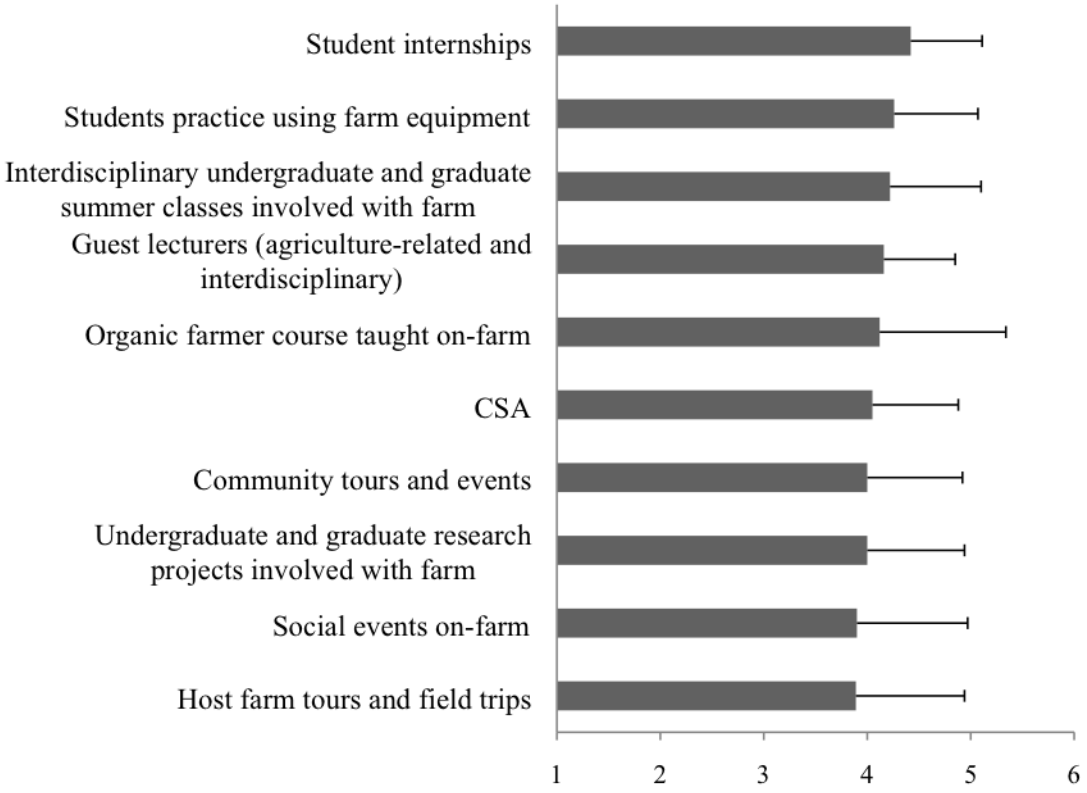

Figure 2.3. Highest ten rated successful educational and outreach strategies (mean, +SD) for college/university students on student farms identified from Delphi survey participants (n=24 total responses generated for this question). Scale: Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5).

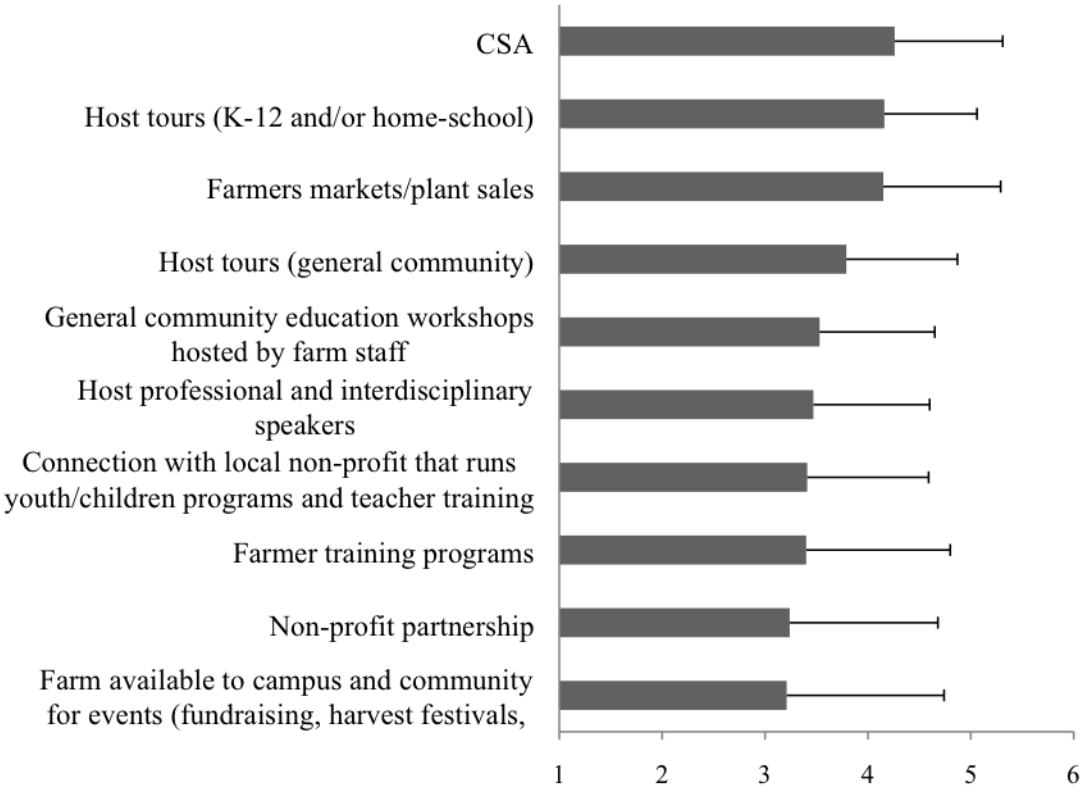

Figure 2.4. Highest ten rated successful educational and outreach strategies (mean, +SD) for community members on student farms identified from Delphi survey participants (n=17 total responses generated for this question). Scale: Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5).

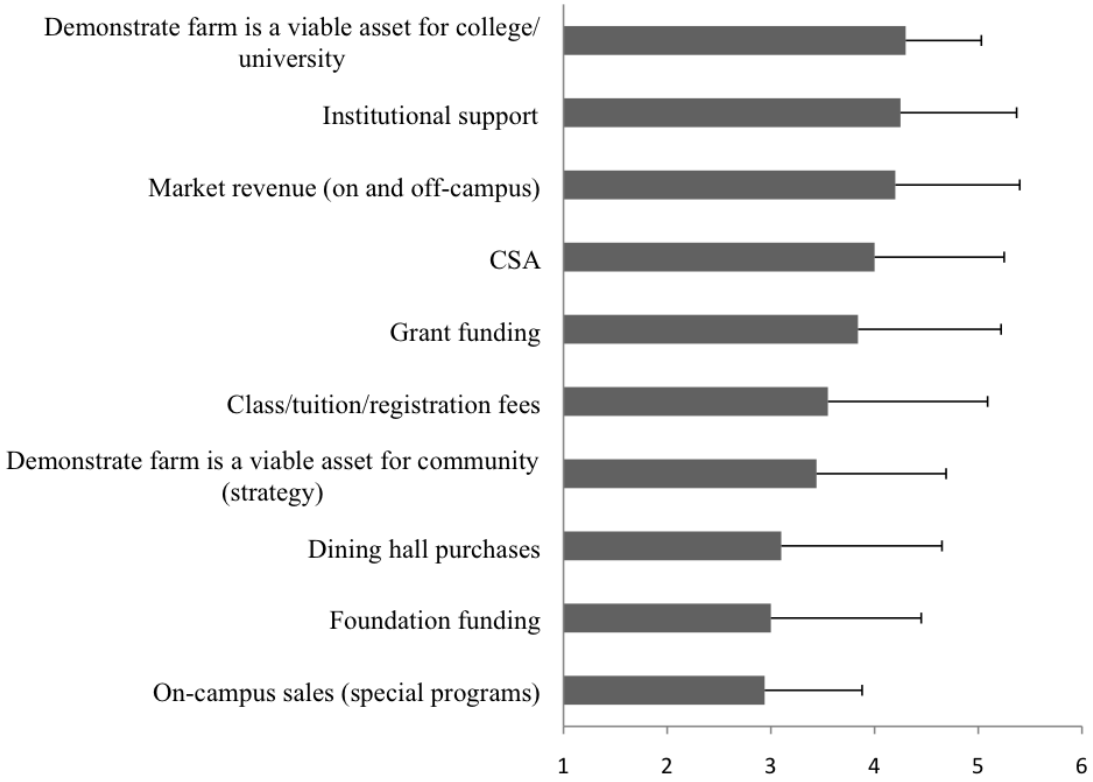

Figure 2.5. Highest ten rated successful funding strategies (mean, +SD) used on student farms identified from Delphi survey participants (n=21 total responses generated for this question). Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5).

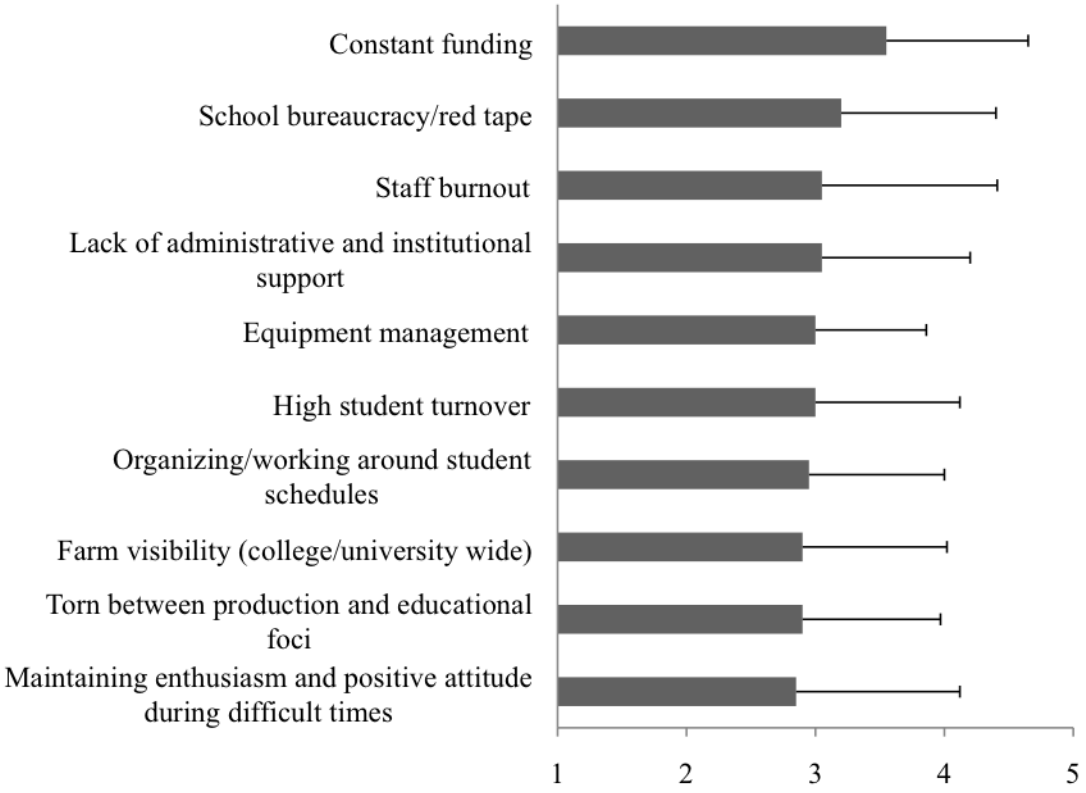

Figure 2.6. Highest ten rated greatest challenges (mean, +SD) experienced on student farms identified from Delphi survey participants (n=27 total responses generated for this question). Scale: Not Challenging (1), Minimally Challenging (2), Somewhat Challenging (3), Challenging (4), Very Challenging (5).

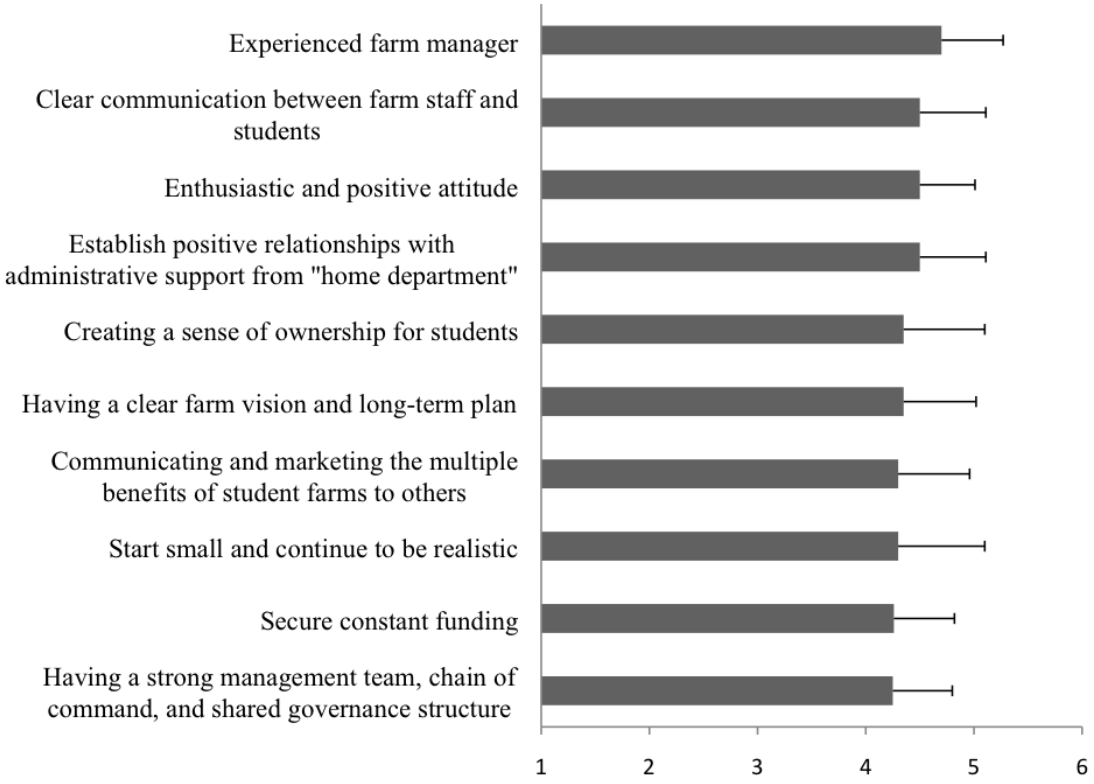

Figure 2.7. Highest ten rated practical solutions (mean, +SD) to commonly experienced challenges and issues on student farms identified from Delphi survey participants (n=22 total responses generated for this question). Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5).

III. A Model Student Farm Design and Development Guide

Introduction

The growing trend of students becoming increasingly interested in organic and sustainable agriculture has been observed throughout the country. In order to meet this demand, sustainable agriculture education (SAE) programs are now found in over 100 colleges and universities nationwide (Parr, 2011). Helping support SAE programs, student farms have been providing hands-on education and practical experiences in sustainable agriculture for over 30 years. Student farms, currently over 40 nationwide (SAEA 2012), are defined as campus educational facilities that provide hands-on opportunities to engage in horticulture, agriculture, and marketing at relatively small scales of production and distribution (Parr and Trexler, 2011). Not surprisingly the primary audience for student farms is college and university students, however there are also opportunities to integrate diverse audiences and community groups as well (Biernbaum, 2011; Kohanowich, 2011; Slotnick, 2011; Van Horn, 2011). While many SAE programs may differ in their specific objective and implementation, two key commonalities are shared throughout these programs; a heavy focus on both multidisciplinary and experiential learning, both of which are focused on student farms (Parr and Trexler, 2011).

The purpose of this paper is to provide a guide and model for establishing and developing a student farm. Information in this report may be particularly useful for colleges and universities interested in starting a student farm, but also may benefit already established student farms through enhancing design and communication components that can further strengthen sustainable agriculture education programs nationwide.

BENEFITS OF STUDENT FARMS

In addition to providing numerous educational opportunities for students, a student farm can also be a place to foster hands-on and experiential learning, facilitate in community outreach and engagement, and further enhance professional and life skill development. Some of the main benefits students can receive from student farms are described in more detail below.

Multidisciplinary Educational Opportunities:

Students from various backgrounds and majors can benefit from the focus on multidisciplinary education within sustainable agriculture on student farms. The integration of disciplines such as horticulture, crop science, soil science, entomology, plant pathology, agricultural economics, and sociology in sustainable agriculture can provide students with numerous opportunities through strategic educational activities on the farm to examine the environmental, social, and economic dimensions of food and farming. Demonstration, field trial, laboratory, and research activities all can be developed on student farms, further increasing the exposure of students to multidisciplinary learning.

Experiential Learning Opportunities:

Student farms provide numerous hands-on and experiential learning opportunities through formal activities such as internships, apprenticeships, and future-farmer training programs. These opportunities allow for day-to-day exposure to developing skills in sustainable

agriculture practices, working with various types of farm equipment, as well as gaining experience in marketing strategies and the economic aspects of agriculture. However, numerous less formal programs but experiential learning activities that occur in short periods can also be developed

Community Outreach and Engagement:

Student farms can also offer opportunities to engage and serve various community individuals and groups that surround the student farm. Engagement with community organizations helps extend the knowledge and exchange of ideas around sustainable agriculture, as well as provides students opportunities to learn more about the importance of community and larger food system aspects of sustainable agriculture. Moreover, the interaction between students and community members can help prepare students for future real life situations and the potential challenges associated when educating diverse audiences about SAE. Further opportunities such as working with Extension agents, K-12 students and teachers, Extension Master Gardeners, and other community members provides students with increased exposure to larger networks of individuals who are also similarly interested in sustainable agriculture. These outreach and education activities can help strengthen the relationships between the community and the institution, as well as promote increased exposure of SAE to diverse audiences.

Professional and Life Skill Development:

Student farms also help provide opportunities for students to learn valuable professional and life skills such as effective communication, organization, teamwork, and planning. Along with these skills and educational opportunities, students may be presented with the opportunity to work with diverse professional organizations (e.g. government organizations, private businesses, non-profit businesses), further helping to increase the students' exposure to various networks of sustainable agriculture experts. Furthermore, students can also benefit from opportunities allowing more experienced students to act as educators and leaders working with youth and other community members on the student farm. Finally, additional skill development may be developed from increased experience with agricultural marketing and economics.

STEPS TO DEVELOP A STUDENT FARM

There are multiple steps that can be taken in order to successfully establish and develop a college/university student farm. Many of these fundamental components are highlighted below, as these are strategies that have been observed in the development of student farms. While we have ordered these steps from our experience and insight from student farm leaders described in Chapter 2, each student farm may develop these differently depending on specific interests and resources. Throughout these steps, we will highlight specific examples from our experience at the Agroecology Education Farm (AEF) at North Carolina State University (NCSU).

1. *Form core group/advisory board, goals, and mission statement*:

It is critical to first identify a group of individuals that will serve as the core group, or an advisory board for the student farm. These individuals may be diverse in profession and background, but it is strongly recommended that there are advisory board members who are faculty, administrators, as well as students at the student farm's respective institution. Additionally, these individuals must be highly invested in furthering SAE at their respective institution, and are ultimately committed to the successful development, establishment, and continual operation of the student farm. Tasks for this advisory board may include assisting in student farm planning, management, fundraising, communications, and developing educational materials made useful for the student farm and respective SAE program. Examples of individuals who may useful on a student farm advisory board include:

- College/university faculty members
- College/university administrators (ex. department heads, deans, provosts, president)
- College/university employees and staff member (ex. college/university dining directors or chefs, campus recreation organizations, etc.)
- College/university alumni
- College/university students (undergraduate and graduate)
- Cooperative Extension agents
- Government and non-government organization personnel (ex. NRCS, USDA professionals)
- Local community business partners

- Other community groups surrounding the farm (ex. parks, K-12 schools, Extension Master Gardeners, etc.)

Once an advisory board has been assembled, the next most important step is to form a mission statement and attainable objectives for the student farm. These two items will serve as the backbone for student farm development and any decision-making processes. Important to note, a student farm is an educational facility, and should be reflected in the statement and objectives put forth by the student farm. The advisory committee should first identify its target audience (see section three, *Identifying Target Audience and Developing Educational Foci*) in developing the overall purpose of the student farm. A sample mission statement and objectives from the NCSU AEF is below.

> "*The mission of the Agroecology Education Farm is to promote agroecology and sustainable agriculture education by providing a diversity of experiential learning opportunities and a facility for North Carolina State University students, faculty, and the local community.*"

Through an interdisciplinary group of NCSU students, faculty, alumni, staff, and partnership, we aim to:

- Engage NCSU students in new opportunities for sustainable agriculture education and farm management.
- Provide hands-on experiences in agroecology, sustainable and organic agriculture concepts and practices for a diversity of audiences.

- Provide a site for people of diverse educational, cultural, and professional backgrounds to connect around local food systems, organic and historic North Carolina agriculture.

2. *Land Acquisition:*

There are a number of factors to consider when making the choice of identifying an area for the college/university student farm. First, it is important to consider the specific educational purpose(s) and supporting size of the student farm. Therefore identifying a suitable location that can support the educational and production activities that will take place on the farm, factors such as prior land-use, soil and environmental conditions, marketability, and supporting infrastructure all must be considered. Secondly, at all costs if possible, the advisory board should encourage a location for the student farm on-campus. If not on campus, farm visibility at the institution and transportation for students to and from the student farm may provide serious challenges in the future. Lastly, identifying a location that is accessible to community groups and members is also important to consider.

3. *Identifying Target Audience and Developing Educational Foci:*

Properly identifying the main target audience and developing appropriate educational materials is vital for the student farm. Collaborative efforts between the advisory board, college/university administration, and any farm staff must specifically identify who they wish

to reach and how. To assist this process, it may be helpful to brainstorm the following questions with the advisory group.

- Who are we trying to reach? Solely students? Undergraduate or graduate, or both? Outside community groups and members?
- What are the educational objectives? Sustainable agriculture educational topics may include aspects of soil management, pest management, crop diversity and rotation, animal husbandry, machinery use, marketing, post-harvest handling, or other subjects. How does the design of the student farm enhance and/or modify the educational objectives previously determined?
- What courses or programs might utilize this student farm? Typical disciplines may include crop science, soil science, entomology, horticulture, etc., but also be prepared to think outside the disciplinary box and consider health and nutrition, history, sociology, economics, architecture, art, etc.
- How are we going to teach the educational focal areas for specific audiences? Through laboratories, classroom activities, undergraduate and graduate research projects, workshops, tours, markets, community or extension workshops?
- What additional personnel, equipment, materials, etc is needed to carry out these educational activities? Extension agents, governmental organizations, K-12 students and teachers?

These questions are not an exhaustive list, but rather an example set of logical questions that the advisory board and college/university administration can consider. Furthermore, throughout the development of the student farm, identifying the target audience to first meet the needs of students is most important. Then, if the student farm is able to facilitate educating additional groups such as outside community members, that should be considered next.

To view an example of student farm educational focal areas from the NCSU AEF, please see Table 3.1.

4. ***Student Farm Design:***

Designing a student farm, or any other agricultural site, it is a multi-step process that draws upon numerous resources. It is important to identify and work with an individual(s) who has design experience, ideally with agriculture or other landscape design-related projects. While it may take time and resource investment, it is recommended that working out ideas on paper with the advisory board, staff, administration and designer should occur first. The following describes basic design steps with specific reference to the NCSU AEF. These steps include: first, creating a base map, secondly, conducting a site analysis, thirdly, programming for the student farm, next drawing bubble diagrams, then finally transferring those drawings into basic schematics and final design(s).

a. Base Map Creation:

A base map is a basic site drawing that displays all built components, in-place vegetation, and topographical information that currently pertain to a site. This base map drawing serves as the starting point for any future design project; therefore it is important to display only the most current and up to date information on this drawing.

To properly create a base map for a student farm, the following steps and measurements will be helpful:

a. *Survey the site for topographical information:*
   - Help can be gained through accessing a local GIS site (example: http://maps.raleighnc.gov/iMAPS/index.html) where general contour lines can be displayed from online imagery. Consulting help from local Extension agents and NRCS (Natural Resource Conservation Service) professionals can also aid in generating the site's topographical information.

b. *Measure any pre-existing built structures such as sheds, barns, houses, etc:*
   - This can be done simply by accessing old construction plans if any sheds, barns, or houses are present on the site. If not available, two people can measure the dimensions of any built structure. Additionally, make note of any specific electrical, cable, or sewage lines that may be present on the site. Knowledge of these items is necessary and can help avoid any future building and developing problems.

c. *Measure any in-place vegetation:*

- Detailing any existing vegetation (i.e. large trees and other plants) is vital. Canopy spread measurements should be taken in order to identify any possible shading issues.

d. *Transfer all contours, measurements, pre-existing vegetation and structures onto base map:*

- Use a large a piece of trace paper (24'' x 36'' recommended) and an appropriate scale (an engineers or architectural scale) to create the base map. Pencil drawings are recommended first, as you can ink in the base map components once all is correctly placed and finalized.

To view an example of a base map from the NCSU AEF, please see Figure 3.1. This is a basic drawing that identifies the main built and in-place components of the NCSU AEF (i.e. access road, tool shed, pole barn, forest, beneficial habitat, tree line, etc.).

b. Conduct a Site Analysis:

A site analysis is simple graphic that is used to provide multiple types of information to the future designers. A proper site analysis should include the following components:

a. *Topographical influence on hydrology patterns:*

- Understanding the slope and contours of the site will help in analyzing hydrology patterns, places for potential runoff, pooling, dry areas, etc.

b. *Soil types and classification:*

- Soil classification can be determined with help from local land-grant university professionals, Extension agents, additional agricultural professionals (USDA, NRCS, etc.), or via online resources (example: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

c. *Wind patterns:*

- Properly assessing wind flow will help dictate future crop orientation, areas of potential pest and disease buildup, as well as areas prone to excessive flooding or drying.

d. *Potential vehicle traffic and pedestrian traffic patterns:*

- Areas that receive high vehicle (visitors or farm equipment) and pedestrian traffic are areas prone to soil compaction. Additionally, these areas provide opportunities to become welcoming walkable pathways, and areas for gathering and orientation.

e. *Vegetation effects on sun patterns:*

- Vegetation plays a huge role on any potential shading and high-sun areas. Track the sun patterns through both the high growing season and the low season to properly assess the solar patterns that are present in the site.

f. *Compass, appropriate scale, and any future notes:*

- As always, providing a compass, the appropriate scale of the drawing, and making notes (examples: areas of high sun, wind, shade, or noteworthy vegetation and built structures) on the site analysis will prove helpful in any future design projects.

To view an example of a site analysis from the NCSU AEF, please see Figure 3.2. This drawing serves to show mostly abiotic elements about the NCSU AEF, although trees and existing vegetation are present. The arrows are coded accordingly in order to provide the designer and staff with a general direction and orientation of the specific legend components. Large blue arrows are used to signify water movement in response to the contours. The black arrows signify general traffic and pedestrian flow. You will also see grey areas indicating shade, as well as yellow to red areas signifying large sun areas. The green areas represent the highly wooded area and the pink areas designate locations that are prone to potential flooding.

c. Transferring Educational Ideas Into Design Bubble Diagrams:

Once the types of educational focal areas that will be implemented on the student farm are identified (see section three, *Identifying Target Audience and Developing Educational Foci*, and Table 3.1), it is necessary to consider the site development needs that facilitate these specific educational goals. An underlying principle that will prove helpful in any future design project(s) is to "design for the activity." The combination of the advisory board and staff's determined focal areas, integrated with what is physically, economically and most importantly educationally feasible at the student farm, will help improve the design process. It is best to next begin the process of drawing bubble diagrams. Bubble diagrams are simple drawings that are made on a piece of paper overlaying the base map that begin to locate specific structures and/or built elements that may be implemented at the student farm. These bubble diagrams are not final, but rather begin to layout possible working structures,

pathways, connections, and designable components of a student farm. The idea is to start small and keep these drawings simple. This allows the designer to see and work through transition spaces, possible complicated areas due to field logistics, and future designable components.

To view examples of bubble diagrams from the NCSU AEF, please see Figures 3.3 and 3.4. Using the base map, site analysis and determined educational focal areas for the NCSU AEF (Table 3.1), this simple drawing was made to begin inserting and start working through general orientation and placement for those previously identified designable elements.

d. Basic Schematic Design:

Once you have been able to create bubbles for specific areas and ideas for the student farm, the next step is to create a basic schematic drawing. This drawing, simply stated, is a preliminary final design, where area for edits and/or improvement is not only allowed, but also encouraged. However, the appropriate scale, orientation, and general sizes and layout of all built structures and/or design components should be in an almost final form. This is also the time to present this design to an advisory board, or the student farm staff. Gathering feedback from these individuals will help the designer work through any possible problems, logistical complications, or inspire new ideas.

To view an example of a basic schematic drawing from the NCSU AEF, please see Figure 3.5. All built-elements, pathways, garden areas, etc. have been designed and placed within the farm. This drawing represents the final design drawing, minus the rendering (i.e. color).

e. Final Design:

Once all advisory board members, student farm staff, and any future student farm leaders have agreed upon a schematic design, it is now time to create a final plan. This plan should be clean, inked, rendered (i.e. colored), with all components properly labeled and to the correct scale. Labeling design components (examples: road signs, structures, geographic orientation arrows, etc.) is critical in ensuring proper understanding of any built component and/or production area that may be in question by a potential viewer or funder. It is also strongly encouraged that this final design plan can make for an important visual to present to any possible funding or administrative personnel (department heads, deans, provosts, funding agencies, etc.). Showing administrative personnel and possible funders a well-designed and attractive landscape can hopefully lead to potential funding and support opportunities.

Lastly, it's important that this student farm design is a flexible template. These designs simply provide a roadmap for the student farm.

To view an example of two final design drawings from the NCSU AEF, please see Figures 3.6 and 3.7. These are final design drawings for the NCSU AEF. All structures, gardens,

pathways, etc., are in place, colored, and properly labeled. Orientation arrows and the appropriate scale are provided for the viewer of the drawing.

5. ***Student Farm Food Safety and Liability Concerns:***

Fresh fruit and vegetables have unfortunately been linked to over 450 outbreaks of food-borne illnesses since 1990 (Chapman, 2012). Therefore, in preparation for a high volume of student and community groups visiting the student farm, creating a food safety and liability plan that can help eliminate possible hazards from occurring may be helpful. A plan should begin with on farm practices such as properly sanitizing tools, preparation surfaces and harvest containers, as well as implementing clean washing stations using potable water and the use of safe soil amendment practices can all help reduce the risk of foodborne illnesses (Chapman, 2012). For additional help, the United States Department of Agriculture and Penn State University provide documents that assist farms in receiving the Good Agricultural Practices (GAP) certification. This certification process will ensure that safe practices are being implemented ultimately in effort to prevent any foodborne illness to occur on the student farm (Chapman, 2012). Lastly, in prevention of any liability concern, it may be helpful to use signed waivers for students and community groups that frequent the student farm. These waivers, in addition to clear rules and guidelines for students and volunteers can be created to reduce safety and liability concerns on the student farm.

6. ***Student Farm Budget Plan:***

Developing a budget plan for the student farm will help organize initial, recurring, and future financial expenditures. It is important for the advisory board and student farm leaders to identify expenditures for personnel, equipment, and additional operating expenses. Furthermore, the student farm should also identify all possible funding sources and revenue-generating activities that may be implemented in future stages of development. In reference to previous research completed on student farm development and management (Ratasky, 2013, Chapter 2 of this thesis), nationwide student farm leaders identified various funding strategies that are currently implemented on student farms. Some of these funding strategies included receiving funding from institutional support, market revenue (on and off-campus markets), CSA programs, grant funding, and collecting money from class, tuition, and student registration fees (Ratasky, 2013, Chapter 2 of this thesis).

Organizing these materials into workable spreadsheets or tables may be helpful in keeping track of these records. To view an example of a sample budget worksheet from the NCSU AEF, please see Appendix K.

7. ***Developing and Generating Institutional Support:***

Findings from Chapter 2 of this thesis strongly identified a lack of farm visibility throughout the campus and generating institutional support as common challenges for student farms. Subsequently, participants indicated the communication and marketing of benefits taking

place on student farms, and demonstrating the farm as a viable asset to the institution as important solutions to the challenges previously identified. Therefore, determining and effectively implementing strategies that will establish the student farm as an integral piece of the institution may help increase institutional support from the college/university.

Fortunately, because diverse audiences commonly utilize student farms, opportunities to market and spread communication about the educational benefits of sustainable agriculture education occurring on student farms to broad audiences is present. In effort to increase campus awareness in hopes of generating institutional support, one strategy commonly identified by participants in Chapter 2 and also used in experience at NCSU, is for the student farm to host an event or social function that will attract various campus groups (students, faculty, staff, university dining personnel, sustainability offices, alumni, etc.) and community members. As an example of this, in 2012, the NCSU AEF in collaboration with University Dining hosted a Farm to Fork event for various student groups, faculty, staff, and university administration. Students and representatives from campus-wide organizations were present and able to integrate with one another through discussions, poster presentations, and the sharing of locally produced food served by NCSU's University Dining Services. Strategies like this may be useful for current and future developing student farms, as these events can help various campus organizations intermingle, and ultimately help increase in spreading awareness about the student farm in hopes of generating more institutional support.

After the event has taken place, it is important that student farm leaders actively maintain communication with the students, faculty, staff, and organizations that were present at the

event. Effectively marketing the successes of the event using social media (Twitter, Facebook, internet blogs, etc.) can all be extremely helpful in maintaining engagement of university and community populations, as well as email listserves, newsletters and displaying information (pictures, success stories, student interviews, etc.) on a student farm website. It is important to consider, however, not all students and supporters are able to visit the student farm on a regular basis, therefore, communication strategies like these can ultimately help maintain a strong support network for the college/university student farm. By doing so, the relationship and presence of the student farm within the institution, as well as the outside community can be greatly enhanced.

REFERENCES

Alexander, C., Ishikawa, S., and Silverstein, M. *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford University Press. 1977.

Archer, D., Hume, B., and Chen, A. "Dilmun Hill Student Farm Report." Cornell University Dilmun Hill Student Farm (2009).

Baldwin, K., Beth, D., Bradley, L.K., Davé, N., Jakes, S., Nelson, M. 2009. "Eat Smart, Move More North Carolina: Growing Communities through Gardens." *N.C. Department of Health and Human Services, Division of Public Health*. Raleigh, NC; (2009).

Biernbaum, J. "Michigan State University (2003): Four-Season Student Farming." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 289-305.

Biernbaum, J. "Organic Farming Principles and Practices." Michigan State University Student Organic Farm (2003).

Biernbaum, John, L. Thorp, and M. Ngouajio. "Development of a Year-round Student Organic Farm and Organic Farming Curriculum at Michigan State University." *HortTechnology* 16.3 (2006): 432-436.

Bradley, L.K. and Baldwin, K. "How to Organize an Allotment Community Garden." AG-727W. North Carolina Cooperative Extension (2011): 17 p. Available online at <http://cals.ncsu.edu/hort_sci/extension/documents/ag-727.pdf>.

Chapman, B., Chaifetz, A., Driscoll, L., Gunter, C., and Ducharme, D. "A Handbook for Beginning and Veteran Garden Organizers: How to Reduce Food Safety Risks."

North Carolina Cooperative Extension (2012): 16 p. Available online at <http://nccommunitygarden.ncsu.edu/foodsafety.html>.

City of Raleigh iMaps. City of Raleigh and Wake County iMaps, n.d. Web. 1 Aug. 2012. <http://maps.raleighnc.gov/iMAPS/index.html>.

Clark, Sean and Laura Sayre, eds. *Fields of Learning: The Student Farm Movement in North America.* Lexington, Kentucky: The University Press of Kentucky, 2011.

Curtis, J., Creamer, N., and Thraves, T. "From Farm to Fork: A Guide to Building North Carolina's Sustainable Local Food Economy, a Center for Environmental Farming Systems Report." Raleigh, N.C. (2010).

Draper, C, and D. Freedman. "Review and Analysis of the Benefits, Purposes, and Motivations Associated with Community Gardening in the United States." *Journal of Community Practice* 18.4 (2010): 458-492.

Ferris, J., Norman, C., and Sempik, J. "People, Land and Sustainability: Community Gardens and the Social Dimension of Sustainable Development." *Social Policy & Administration* 35.5 (2001): 559-568.

Joshi, A., Kalb, M., and Beery, M. "Going Local: Paths to Success for Farm to School Programs." *The National Farm to School Program Center for Food & Justice, Occidental College and Community Food Security Coalition* (2006).

Kohanowich, R. "Central Carolina Community College (1995): Growing New Farmers." *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 192-208.

Lovell, S. “Multifunctional Urban Agriculture for Sustainable Land Use Planning in the United States.” *Sustainability* 2(2010): 2499-2522.

Michigan State University Student Organic Farm. “Michigan State University Organic Farmer Training and Information Packet.” (2011).

Parr, D. and C. Trexler. "Students’ Experiential Learning and Use of Student Farms in Sustainable Agriculture Education." *Journal of Natural Resources & Life Sciences Education* 40(2011): 172-180.

SAEA. “Sustainable Agriculture Education Association, National Academic Programs List.” (2012) 1 Mar. 2012 <http://sustainableaged.org/Resources/StudentFarmDirectory/tabid/85/Default.aspx>

Sayre, L. “The NEWFARM: Farming for Credit.” The Rodale Institute, n.d. Web. 24 Mar. 2012. <http://www.newfarm.org/features/0104/studentfarms/studentfarms.shtml>.

Slotnick, J. “University of Montana (1997): Agriculturally Supported Community.” *Fields of Learning: The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 227-245.

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J.A., and J.S. Litt. 2009. “Collective Efficacy in Denver, Colorado: Strengthening Neighborhoods and Health Through Community Gardens.” *Health & Place* 15(2009): 1115-1122.

Thompson, B. “Educational and Training Opportunities in Sustainable Agriculture Annual Report, 19th Edition.” *National Agricultural Library: Agriculture Research Service, U.S. Department of Agriculture*. 2009.

United States Department of Agriculture Natural Resources Conservation Service. Soil Survey: Area of Interest Interactive Map, n.d. Web 1 Aug. 2012. <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>.

Whitmore, R. "Organizational Structures of Select Student Organic Farms." Integra Consulting, 2007. 1-21.

Van Horn, M. "University of California, Davis (1977): Moving from the Margins toward the Center." *Fields of Learning*: *The Student Farm Movement in North America*. Ed. Laura Sayre and Sean Clark. Lexington, Kentucky: The University Press of Kentucky, 2011. 129-148.

Table 3.1. Example Student Farm Educational Focal Areas and Associated Site Development Needs at the NCSU Agroecology Education Farm.

Educational Programming Examples	**Examples of Site Development Needs Matched to Education Program**
Crop diversity management	Cover crops, crop rotations, agroforestry, intercropping
Sustainable water management	Drip irrigation, water catchment, riparian buffers that integrate diverse and native species, planting drought tolerant crop varieties
Sustainable soil and fertility management	Composts, vermicomposts, reduced tillage and associated equipment, integrating cover crops, organic fertility sources
Biological diversity, wildlife and management of natural areas	Maintenance of natural forest edges, promotion and education of native species, beneficial habitats (butterfly and bee habitats) with native species
Ecology of pests and integrated pest management	Beneficial insect habitats, education and signage of common pests and beneficial organisms, demonstrations of organic pest management
Post-harvest, food safety and culinary education for local foods	Teaching pavilion with outdoor teaching kitchen and walk-in refrigeration for events

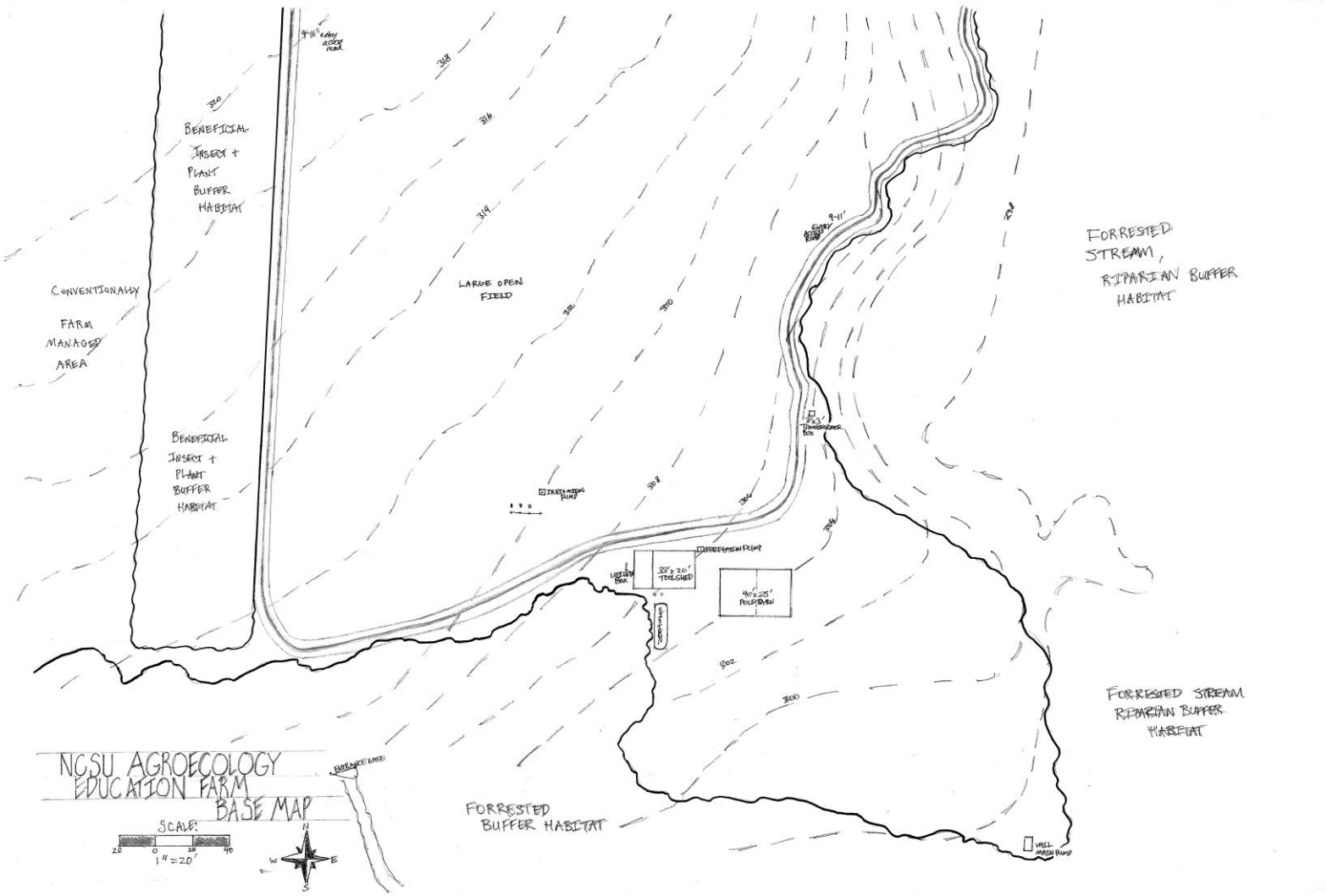

Figure 3.1. NCSU Agroecology Education Farm base map.

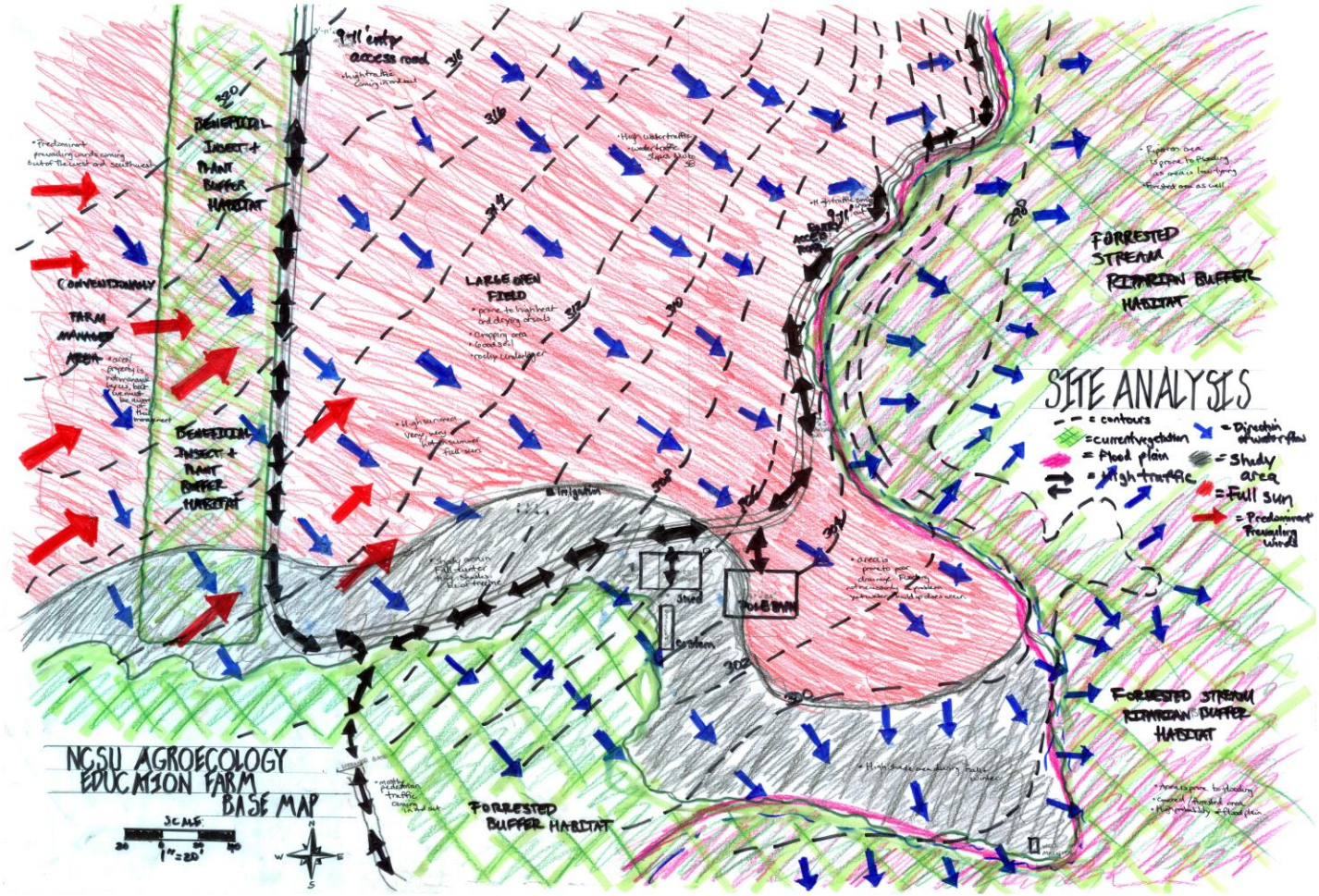

Figure 3.2. NCSU Agroecology Education Farm site analysis.

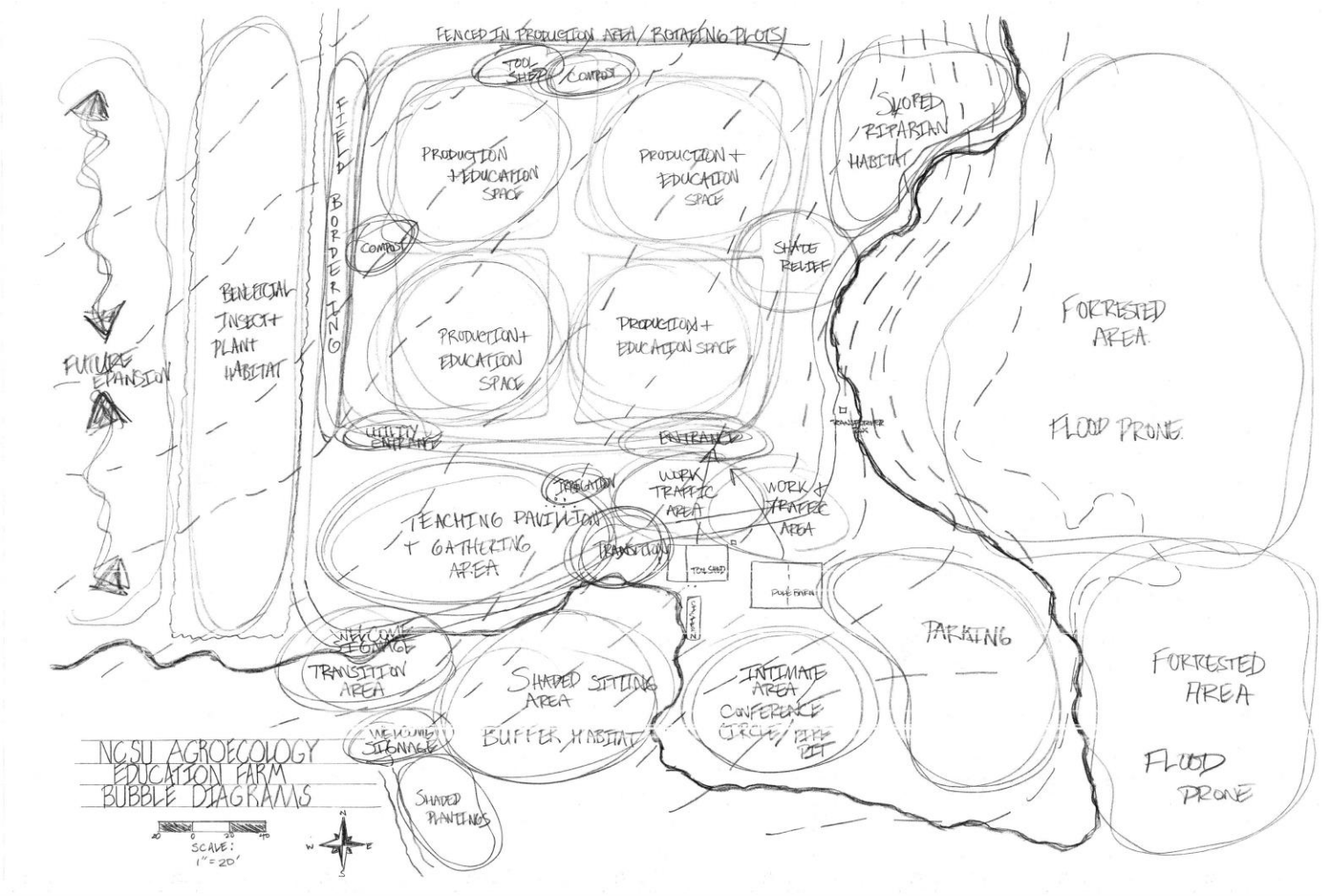

Figure 3.3. NCSU Agroecology Education Farm bubble diagram.

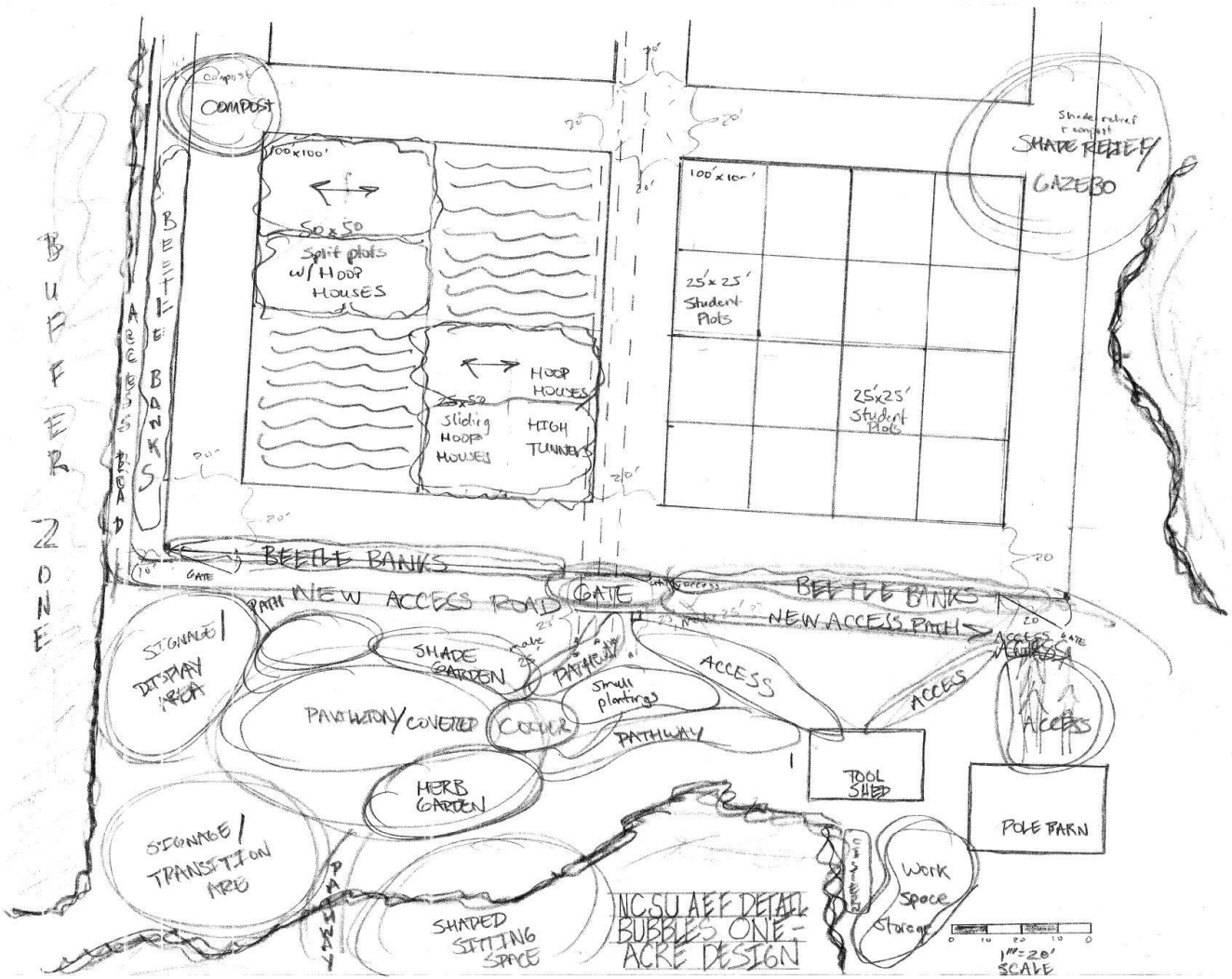

Figure 3.4. NCSU Agroecology Education Farm one-acre design detail bubble diagrams.

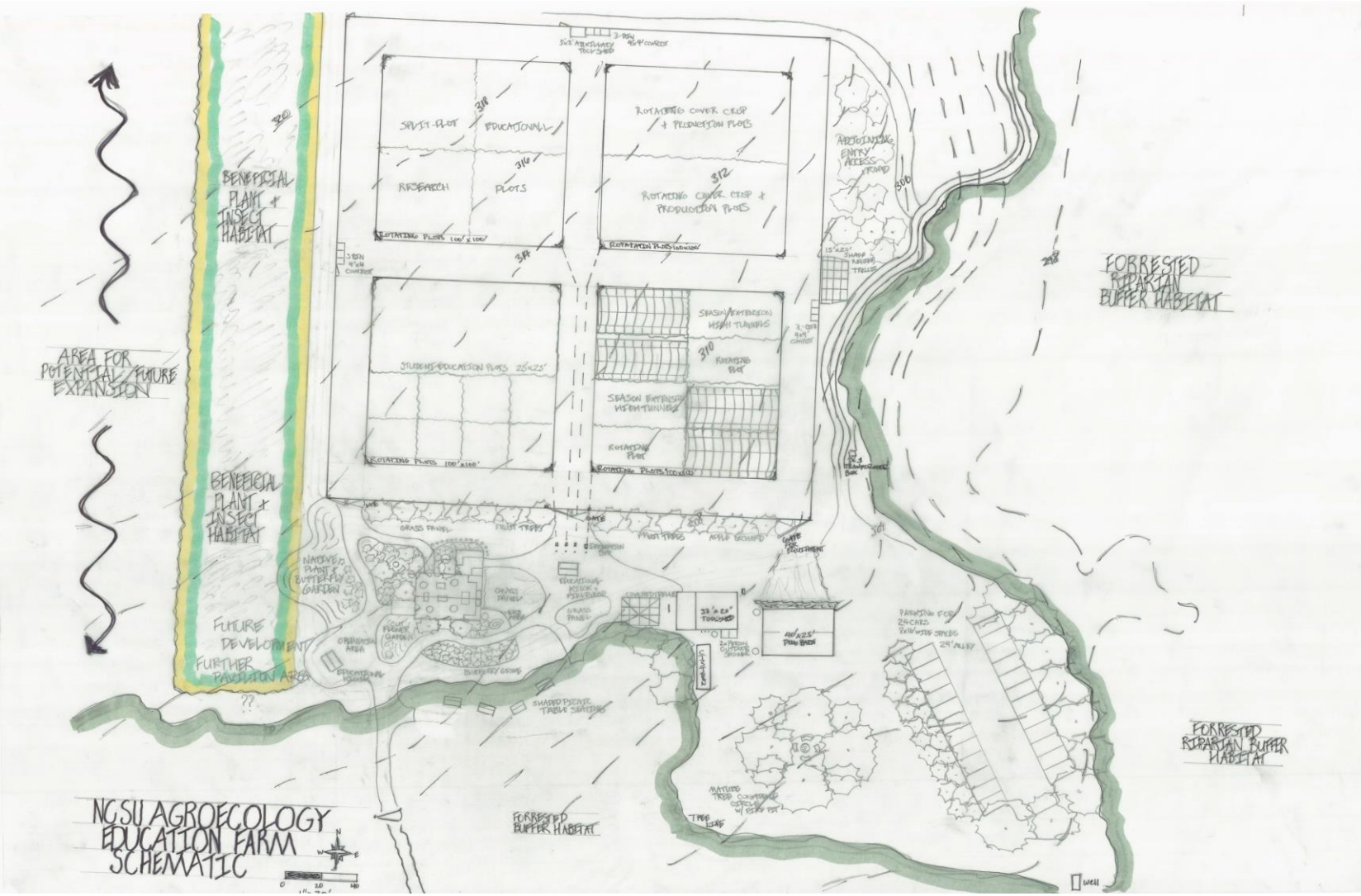

Figure 3.5. NCSU Agroecology Education Farm basic schematic drawing.

Figure 3.6. NCSU Agroecology Education Farm final design drawing.

Figure 3.7. NCSU Agroecology Education Farm final design drawing (extended).

IV. Conclusions

The expanding student interest in sustainable agriculture production and the development of sustainable agriculture education (SAE) programs on colleges and universities has helped augment the development of college/university student farms. Student farms are becoming increasingly popular throughout the country, however little research has effectively shared specific commonalities occurring within these farms. The purpose of this study was to examine the numerous developmental, managerial, and educational strategies currently being implemented on student farms, and furthermore report those lessons learned through creating a design and development guide useful for student farms nationwide.

In order to identify distinctive components occuring on student farms, a ten-question survey was created to specifically gather information from student farm leaders about student farm development, establishment, educational and outreach strategies for students and community, current challenges, as well as solutions used to combat those challenges currently seen on student farms. A three-round online Delphi survey methodology was used in effort to reach a general consensus among the survey participants. Participants first generated responses to the questions, then rated the importance and/or relevance of each response using a simple Likert scale. One of the main findings indentified by survey participants in the first study was the importance of successfully developing and establishing a student farm with a competent farm manager and supporting staff. It was determined that the lack of adequate staff, specifically an experienced farm manager, often led to complications concerning the organization and management of student farm staff and students, as well as further burdened student farm personnel, which also led to staff burnout. However, when student farm leaders were asked to identify common challenges of student

farms, the highest rated response was maintaining constant funding. Although when further asked about solutions implemented on student farms, the highest rated response was having an experienced farm manager. Therefore, despite funding challenges, the importance of hiring and maintaining appropriate personnel within the student farm was explicitly identified.

Further findings identified from survey participants in Chapter 2 included the diverse educational strategies successfully used on student farms. Although most responses concerning educational strategies implemented on student farms focused on students as the primary audience, many activities were identified for the greater community. The implementation of community supported agriculture (CSA) programs, hosting educational workshops, and creating partnerships with non-profit organizations were all highly rated successful responses. Furthermore, a large emphasis was placed on experiential learning activities that were interdisciplinary for both students and community on student farms. Students can benefit from opportunities that foster critical thinking and decision making, but also the ability to gain practical working knowledge in sustainable agriculture through internships, apprenticeship programs, and weekly markets. Community, however, can benefit from student farms through the large participation of student farm and training programs, in addition to fostering partnerships with the student farm to further extend the sustainable agriculture networks into the surrounding community, and taking advantage of the wealth of sustainable agriculture expertise commonly found on student farms. The opportunities for increased community engagement and societal learning exchanges on student farms is strongly suggested, and through this increased engagement, the need for

increased institutional support and further extending the relevance of sustainable agriculture from the institution within the surrounding community may be addressed.

Further findings from our study distinctly identified common challenges and issues present on student farms. While many commonalities such as a lack of funding, support, and overall college/university visibility were identified, helpful solutions such as employing an experienced farm manager, facilitating clear communication between farm staff and students, and also establishing positive relationships with institution administrators were all recognized by student farm leaders. An additional finding strongly identified the difficulty of balancing the production focus and educational focus on student farms. This can prove troublesome on student farms, as many are self-reliant in terms funding resources. Therefore the student farm must stay focused on educating students about sustainable agriculture, while also sufficiently meeting the production standards to maintain operation.

To help combat many of the challenges and issues identified on student farms, additional solutions were identified as having a clear vision and long-term plan for the student farm, as well as maintaining constant funding, and possessing the ability to learn from other student farms. This can prove extremely helpful for student farms nationwide as the importance of properly communicating and marketing the benefits to other Student farms throughout the country was strongly rated. Lastly, student farm leaders identified many educational and outreach activities possible to be implemented on student farms. The breadth of these responses suggest that the innovative ideas of sustainable agriculture educators will ultimately help change the face of student farms, and further promote student farms as integral pieces into sustainable agriculture education nationwide.

The second portion of this thesis, Chapter 3, aimed to provide a unique design and development guide for starting a student farm. The information in this chapter specifically identified multiple components to developing a student farm including identifying the farm's mission, objectives and advisory board, also land acquisition, a process of developing a farm's design from determined educational foci, and finally creating a communication and budget plan.

In aid of student farm development, it is important that the advisory board consists of professionals from multiple disciplines related to sustainable agriculture. This will prove helpful in creating the farm's mission and objectives due to the diverse perspectives that are invested in furthering the development of the student farm. Furthermore, it is also important that the advisory board consists of at least one community member/partner. Integration of community members as student farm users and advocates can further extend the scope and reach sustainable agriculture education and benefit both the community and institution.

When acquiring land and determining the proper location for a student farm, it is important to find a location that is on, or at least very close in proximity to campus for students, but also serve as an accessible and marketable location for the surrounding community. Additionally, it is vital that the land acquired for the student farm also be of a workable size for the determined educational foci. Ensuring that the site can facilitate the types of educational and outreach activities determined for the student farm, as well as sustain future developmental design projects is key. Furthermore, when beginning a new project on a student farm, or the initial development of a new student farm, following proper design steps will greatly assist any student farm personnel. Creating detailed base maps and site analyses drawings will provide student farm personnel with all vital details to consider

when developing on-site. Then, the process of generating ideas into workable scales and built-elements will ultimately create an innovative and attractive student farm.

Lastly, implications for future research and the increased sharing of student farm development and managerial components is highly evident. Student farms serve as a vital support platform for sustainable agriculture education programs, and it is predicted the number and overall improvement of student farms will only increase in time. The potential for future undergraduate and graduate research projects, innovative community engagement programs, and improved production will all help improve SAE at colleges and universities. Moreover, whether beginning or currently operating a student farm, the importance of determining detailed objectives, helpful partners and allies, and conducting a multi-step and holistic design process will only further aid the student farm. Most importantly, a student farm should be a place focused on education through enriched experiential and interdisciplinary learning experiences, but we stress the importance that a student farm should not only serve as a viable asset to the institution, but also deeply extend its reach of sustainable agriculture education into the neighboring community.

APPENDICES

Appendix A

Delphi Round Three: Individual Responses from Survey Question One - Characteristics of a Successful Student Farm (n = 40, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Experiential learning is key	4.80	0.41
Fulltime farm manager	4.75	0.55
Demonstrates sustainable agriculture practices	4.72	0.46
Competent staff	4.70	0.47
Educationally focused	4.70	0.47
Steady source of financial support in place (either from market revenue or department funding)	4.65	0.59
Well organized	4.55	0.51
Environmentally sustainable	4.50	0.61
Provides technical hands-on learning and training experiences	4.40	0.75
Farm and farm staff are welcoming, appreciated, and loved by many	4.35	0.59
Uses appropriate technology and proper agricultural practices	4.35	0.67
Faculty involvement (interdisciplinary and agriculture-based)	4.30	0.66
Displays leadership	4.25	0.55
Farm is clearly linked/well integrated into curriculum	4.25	0.64
Allow students to make mistakes	4.20	0.77
Farm creates positive relationships and partnerships with various campus leaders and programs	4.20	0.77
Close proximity to campus	4.15	0.81
Makes students feel important/empowered in operation and decision making process of day-to-day activities	4.15	0.88
Farm upholds university's mission	4.05	0.69
Team based	4.05	0.89
Agriculturally productive	4.00	0.73
Long-term/Farm-vision goals are identified and shared with the institution	4.00	0.56
Receives full institutional/university support (not just from department or college)	3.95	1.00
Economically sustainable	3.90	0.97
Makes realistic expectations	3.89	0.57
Offers a place to produce, cook, and enjoy food with others	3.85	0.88
Generates own farm revenue	3.75	0.97
Offers a diversity of educational programs	3.75	0.79
Progressive philosophy	3.75	0.91

Continued next page…

Appendix A continued.

Engages local community	3.70	0.73
Students receive educational credit for participation	3.70	0.86
Visibility in local community and media	3.70	0.80
Farm has a tenured professor involved with the program	3.60	1.23
Learning is valued over technical training	3.50	0.83
Large number of participants	3.40	0.68
Faculty specifically use farm for research and extension activities	3.35	1.09
Ability to pay students	3.10	0.97
Provides future opportunities for students AFTER school/time spent on farm	3.05	1.05
Volunteer program	3.05	1.13
Connection to dining hall made	2.95	1.28

Note. Rating Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)

Appendix B

Delphi Round Three: Individual Responses from Survey Question Two - Components Necessary for the Establishment of a Student Farm (n = 34, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Experienced farm manager	4.65	0.67
Fulltime farm manager	4.60	0.68
Land (acquisition and tenure)	4.55	0.51
Startup budget	4.50	0.61
Committed team members with team-based and leadership qualities, and desire to involve others	4.45	0.60
Organized and competent farm staff all with relevant knowledge and experience	4.45	0.69
Working space and storage facility	4.45	0.60
Faculty team/support	4.40	0.60
Transportation to/from farm if off campus and/or easy to access	4.40	0.50
Proper equipment (in-field and hand tools)	4.30	0.66
Student interest and sense of ownership through learning processes is maintained	4.30	0.86
Administrative support	4.25	0.72
Collaboration between students, faculty, staff, and administration on farm goals	4.20	0.89
Multiple sources of funding/revenue generating system in place for future (market and business plan)	4.11	0.74
Organized infrastructure	4.10	0.45
Organized long-term plan	4.10	0.64
Farm is a workable scale	4.05	0.83
Greenhouse	4.05	0.94
Clear farm design	3.90	0.79
Holistic management approach	3.90	0.97
Diverse production systems offered	3.75	0.55
Progressive approach	3.75	0.91
Interdisciplinary support	3.65	0.75
Land on campus	3.65	1.31
Aesthetically pleasing farm	3.55	0.69
Educational and market coordinator	3.55	0.89
High-quality land	3.53	0.70
Database for collecting on-farm information (plant cultivars, production facts, etc.)	3.50	1.10
Communication coordinator	3.45	1.00
Classroom	3.40	0.99

Continued next page…

Appendix B continued.

Covered and open-air meeting place with cooking and eating facilities/are	3.20	1.15
Volunteer program	3.15	1.14
Community involvement and/or partnership with local community partner	3.05	0.89
Designated parking area	3.05	0.94

Note. Rating Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)

Appendix C

Delphi Round Three: Individual Responses from Survey Question Three - Factors Necessary for Sustaining the Long-Term Management of a Successful Student Farm (n = 26, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Experienced and dedicated farm manager and staff	4.75	0.55
Administrative support (personnel and funding)	4.60	0.50
Effective communication	4.60	0.50
Enthusiastic and positive attitude	4.50	0.61
Faculty support	4.45	0.60
Farm manager has proper benefits, vacation time, is treated well, etc.	4.40	0.75
Students feel sense of ownership and importance at farm	4.40	0.60
Teamwork/team based	4.40	0.69
Agriculturally and technically proficient	4.35	0.59
Maintains student involvement and interest in SUMMER months (when most students leave)	4.35	0.89
Constant student engagement and interest	4.30	0.80
Farm directly linked to in-class activities and degree programs within curriculum	4.30	0.66
Clear vision/long-term farm plan	4.20	0.77
Creates measureable learning outcomes for class and farm activities, while documenting and reflecting upon those accomplishments	4.11	0.81
Farm makes realistic expectations	4.10	0.45
Reliable equipment	4.10	0.45
Farm properly manages and sustains growth in production and programming	4.00	0.58
Organized chain of command	4.00	0.80
Ability to generate constant on-farm revenue	3.95	0.76
Clear farm design	3.95	0.69
Reinvests profits back into farm	3.95	0.83
Community engagement and/or community partnership	3.40	0.68
Website	3.40	0.82
Graduate of program is able to go into paid farm position after completion of degree/program	3.32	1.00
Collects donations	2.90	1.21
Connection to dining hall	2.85	1.14

Note. Rating Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)

Appendix D

Delphi Round Three: Individual Responses from Survey Question Four - Successful Educational and Outreach Strategies for College/University Students on Student Farms (n = 24, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Student internships	4.42	0.69
Students practice using farm equipment	4.26	0.81
Interdisciplinary undergraduate and graduate classes involved with farm during summer months	4.22	0.88
Guest lecturers (agriculture-related and interdisciplinary)	4.16	0.69
Organic farmer course taught on-farm	4.12	1.22
CSA	4.05	0.83
Community tours and events	4.00	0.92
Undergraduate and graduate research projects involved with farm	4.00	0.94
Social events on farm	3.90	1.07
Host farm tours and field trips	3.89	1.05
Joint educational partnership projects with various campus programs (education department, dining services, design and build projects, etc.)	3.89	0.90
Students plan actual farm activities for that semester/season	3.80	1.20
Harvest festivals	3.74	1.15
Farm staff and student work days	3.68	1.16
On-campus farmers market	3.68	1.25
Farmer teaching programs	3.60	0.99
Provide food to other campus events and students participate	3.60	1.10
Livestock caring activities	3.59	1.37
Creative/special projects	3.50	0.89
Graduate research	3.25	1.18
Volunteers	3.20	1.47
Host international students	3.18	0.95
Extension workshops	3.17	1.25
Farm-to-Fork activities	3.13	1.02

Note. Rating Scale: Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5)

Appendix E

Delphi Round Three: Individual Responses from Survey Question Five – Successful Educational and Outreach Strategies for Community Members on Student Farms (n = 17, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
CSA	4.26	1.05
Host tours (K-12 and/or home-school)	4.16	0.90
Farmer's markets/plant sales	4.15	1.14
Host tours (general community)	3.79	1.08
General community education workshops hosted by farm staff	3.53	1.12
Host professional disciplinary and interdisciplinary speakers	3.47	1.13
Connection with local non-profit that runs youth and children programs, curriculum design, and teacher training	3.41	1.18
Farmer training programs	3.40	1.40
Non-profit partnership	3.24	1.44
Farm available to campus AND community for events (fundraising, annual harvest festivals, donations, etc.)	3.21	1.53
Connection with local food cooperatives and vendors	3.12	1.67
Volunteer workdays	2.94	1.30
Workshops hosted by Extension agents	2.88	1.31
Master Gardener classes	2.76	1.25
Ongoing K-12 educational programs	2.60	1.64
Animal raising and donation projects for local farmers	1.77	1.36
Senior involvement programs	1.75	0.75

Note. Rating Scale: Not Successful (1), Minimally Successful (2), Somewhat Successful (3), Successful (4), Very Successful (5)

Appendix F

Delphi Round Three: Individual Responses from Survey Question Six – Successful Funding Strategies for Student Farms (n = 21, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Demonstrate farm is a viable asset for university (strategy)	4.30	0.73
Institutional support	4.25	1.12
Market revenue (on and off-campus)	4.20	1.20
CSA	4.00	1.25
Grant funding	3.84	1.38
Class/tuition/registration fees	3.55	1.54
Demonstrate farm is a viable asset for community (strategy)	3.44	1.25
Dining hall purchases	3.10	1.55
Foundation funding	3.00	1.45
On-campus sales (special programs)	2.94	0.94
Donations	2.79	1.32
Endowment funding	2.78	1.44
Non-credit farmer teaching program	2.28	1.56
Fundraising events	2.22	1.17
Corporate and community partners	2.21	1.40
Payment for courses taught to the community	2.17	1.10
Workshop fees	2.17	1.10
Charge college/university researchers for using farm's resources (land, personnel, equipment, etc.)	2.06	1.21
Student government funding	1.67	1.03
Tour fees	1.61	0.78
Loans	1.11	0.32

Note. Rating Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)

Appendix G

Delphi Round Three: Individual responses from Survey Question Seven – Greatest Challenges Experienced on Student Farms (n = 27, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Constant funding	3.55	1.10
School bureaucracy/red tape	3.20	1.20
Lack of administrative and institutional support	3.05	1.36
Staff burnout	3.05	1.15
Equipment management	3.00	0.86
High student turnover	3.00	1.12
Organizing/working around student schedules	2.95	1.05
Farm visibility (college/university wide)	2.90	1.12
Torn between production and educational foci	2.90	1.07
Maintaining enthusiasm and positive attitude during difficult times	2.85	1.27
Sustaining farm manager's salary	2.80	1.40
Distance from campus	2.75	1.41
Quality of labor/competent staff	2.75	1.12
Understanding the complexity of the university bureaucracy	2.75	1.02
Lack of organized infrastructure and establishment	2.70	1.38
Surrendering decision process to inexperienced students	2.70	1.03
Lack of classes supported by "hard money"	2.65	1.32
Lack of common vision and value among faculty involved	2.65	1.50
Cost of student mistakes	2.60	0.94
Unclear organizational structure and areas of responsibility for student, faculty, and staff	2.60	1.10
Farm not deeply embedded into agricultural curriculum	2.50	1.36
Having too high of expectations	2.45	1.23
Battling to conform to university's "image"	2.40	1.23
Lack of faculty support	2.40	1.27
Unclear vision/long-term plan	2.40	1.05
Sustaining high student interest and involvement	2.21	1.08
Land tenure	2.15	1.50

Note. Rating Scale: Not Challenging (1), Minimally Challenging (2), Somewhat Challenging (3), Challenging (4), Very Challenging (5)

Appendix H

Delphi Round Three: Individual Responses from Survey Question Eight - Greatest Issues Experienced on Student Farms (n = 30, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Lack of time	3.40	1.31
Continuous funding	3.25	1.25
Difficulty to make a living in agriculture	3.25	1.16
Data collection and documenting results from educational outcomes is difficult	3.10	1.07
Sustaining full institutional support (trustees, administration, faculty, etc.)	2.95	1.54
Difficulty when working with various organizations (acquiring building permits, livestock permits, licensing, city irrigation regulations, etc.)	2.85	1.04
Balancing production focus with educational focus	2.80	1.11
Lack of explicit system for student shared governance	2.70	1.45
Expressing the real value of the farm to others (college/university and community)	2.65	1.09
Increasing privatization of public university results in less support for experiential educational programs	2.65	1.42
Lack of competent and engaged farm manager	2.65	1.69
Lack of faculty and staff whom are competent in agriculture/horticulture, as well as other social sciences	2.65	1.57
Lack of teamwork and organized chain of command	2.65	1.23
Downsizing department results in overworked employees (farm faculty and staff)	2.63	1.12
Archaic and non-progressive mindset	2.55	1.32
Competition with other programs for funding sources	2.50	0.95
Lack of student experience and skills	2.50	1.40
Land near campus	2.50	1.57
Students leaving in summer prove difficult for farm development	2.45	1.32
Lack of clearly defined purpose of farm in curriculum and goals	2.40	1.27
Lack of willingness to invest in what may be risky	2.40	1.10
Current lack of appreciation for agriculture in our society	2.25	0.91
Lack of proper waste management and toilet facilities	2.20	1.28
Patience of students and faculty for development	2.15	1.27
Establishing a farm at a liberal arts college is challenging	2.06	1.06
Lack of confidence in organic agriculture	2.05	1.15

Continued next page…

Appendix H continued.

Pressure/need to tie the farm into an area of scholarship for the college/university	2.05	1.19
Maintaining student interest and enthusiasm	2.00	1.26
Aging personnel	1.95	1.10
Permitting activities on private land	1.37	0.60

Note. Rating Scale: Scale: Not an Issue (1), Minimally an Issue (2), Somewhat an Issue (3), Issue (4), Very much an Issue (5)

Appendix I

Delphi Round Three: Individual Responses from Survey Question Nine - Practical Solutions to Commonly Experienced Challenges and Issues on Student Farms (n = 22, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Experienced farm manager	4.70	0.57
Clear communication between farm staff and students	4.50	0.61
Enthusiastic and positive attitude	4.50	0.51
Establish positive relationships with administrative support from "home department"	4.50	0.61
Creating a sense of ownership for students	4.35	0.75
Having a clear farm vision and long-term plan	4.35	0.67
Communicating and marketing the multiple benefits of student farms to others	4.30	0.66
Start small and continue to be realistic	4.30	0.80
Securing constant funding	4.26	0.56
Having a strong management team, chain of command, shared governance structure and all roles for all parties (students, faculty, staff, and administration) are clearly defined	4.25	0.55
Positive faculty and administrative support	4.25	0.72
Ability to learn from other student farms	4.15	0.88
Progressive operational philosophy	4.00	0.65
Holistic management approach	3.80	1.15
Make farm indispensable to campus and community through innovative projects and programs	3.80	1.01
Reliable farm equipment	3.75	0.85
Maintaining constant exposure in public's eye (farmers and community)	3.45	0.83
Advertise farm to multidisciplinary classes/fields	3.35	0.93
High quality of labor	3.25	0.91
Having community partners lobby administration on farm's benefit	3.10	0.97
Engage faculty to work at the farm as part of their work duties (from all disciplines)	3.00	0.97
Reinstitute agricultural and additional technical skill training in high school to better prepare students for college	3.00	1.21

Note. Rating Scale: Not Important (1), Minimally Important (2), Somewhat Important (3), Important (4), Very Important (5)

Appendix J

Delphi Round Three: Individual Responses from Survey Question Ten - Possible Educational and Outreach Strategies for College/University Students and Community Members on Student Farms (n = 24, M = Mean Response Value, SD = Standard Deviation)

Responses	*M*	*SD*
Undergraduate and graduate courses taught on-farm	4.42	0.84
Diversity on-farm lessons (examples: wildlife biology, post-harvest physiology, animal production systems, value-added projects, mushroom cultivation, energy conservation, cooking courses, etc.)	4.35	0.75
Dining hall programs	4.26	0.99
Food bank donation programs	4.21	1.03
Train-the-Trainer workshops	4.11	0.99
Innovative on-farm energy projects and demonstration areas	4.00	0.97
Service-learning opportunities	3.95	0.71
Student-taught laboratories and field activities	3.95	0.85
Fundraising activities and social events	3.94	0.80
Graduate research efforts	3.94	1.26
Increase farm tours and educational field days	3.90	0.91
Student residence hall (sustainability and food-system themed)	3.89	1.10
Increase community outreach	3.75	0.91
Social and food justice workshops	3.75	1.12
Increase high school collaborations	3.55	1.00
Post-graduate apprenticeships	3.28	1.27
Post-graduate internships	3.22	1.22
Non-student apprentice and beginning farmer-training programs	3.10	1.29
Partnership with local food cooperative	3.10	1.02
Location on-farm for community garden plots	2.95	1.50
Home school programs	2.78	0.94
Boy and Girl Scout programs	2.72	1.13
Residential weekend workshops	2.58	1.17
Raising animals for local farmers	2.45	1.28

Note. Rating Scale: Scale: Not Possible (1), Minimally Possible (2), Somewhat Possible (3), Possible (4), Very Possible (5)

Appendix K

Sample Budget Worksheet

Item	Estimated Amount	Possible Funding Source or In Kind Donation	Comments
Startup Expenses			
Land			
Farm Manager or Education Coordinator (salary and fringe benefits)			
Student assistant labor			
Irrigation (may include site analysis, digging well, water storage, irrigation supplies)			
Tool shed(s)			
Large farm equipment (tractor, bushhog, etc.)			
Farm vehicle/truck			
Misc. equipment supplies (e.g., tools, emergency/safety items, gloves, seed storage, etc.)			
Soil amendment (fertilizers, composts)			
Seeds/transplants (crops, cover crops, beneficial habitats)			
Animals (if used)			
Pest management (e.g., electrified deer fence, organic pest management)			
Outdoor seating			

Continued next page.

Appendix K continued.

Shade structure (if necessary)				
Bathrooms/ hand washing (rental or building)				
Compost units				
Hand tools				
Signage and display materials				
Refrigeration / food storage (if necessary)				
Recurring Expenses (annual)				
Land rental (if necessary)				
Farm manager/staff salary, benefits, training (conferences and workshops)				
Student assistant labor				
Electricity				
Water (if necessary)				
Composts, mulches, and manures				
Soil amendments				
Seeds/transplants				
Animals and animal feed or supplies				
Replacement tools				
Farm equipment and vehicle fuel				
Farm equipment maintenance				
Educational materials				

Continued next page.

Appendix K continued.

*Note: These items simply display an example list of possible budgeted items. Each institution should design their student farm's budget to specifically meet their needs and available resources.