GLOBALIZATION AND AGRICULTURE: ENSURING A SUSTAINABLE FUTURE

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GLOBALIZATION AND AGRICULTURE:
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ABSTRACT

GLOBALIZATION AND AGRICULTURE: ENSURING A SUSTAINABLE FUTURE

by Sarah Linn Gallardo

As healthy agricultural systems are essential for healthy and secure populations, so it becomes important to frame agricultural production and production security as strategic assets. Moving forward with a global population of over 7 billion, agricultural policies must protect production and distribution from internal and external threats, but also ensure people have reasonable access to ample quantities of quality, safe food. As agriculture as a broad topic does not hold the attention of the general public, many challenges and consequences of current policy and practice are not well understood.

The initial steps to address the need to bring agriculture to the forefront of popular current issues are through education. To this end, I developed a course focused on global sustainability, agriculture as a system, and its relationships to other systems such as economics, food security, energy, climate, and the environment. The project yielded a 16-week course with ten modules that may be used consecutively during as a semester-long academic course or that may be used independently for a wide range of audiences and settings.

The purpose in developing and teaching this material is to encourage critical thinking on a systems level in order to conceptualize new sustainable agricultural policy and practice for a sustainable global future.

ACKNOWLEDGMENTS

It is my pleasure to thank those involved with making this master's project a success. The culmination of this project was truly a community event. I am forever thankful for everyone who supported me.

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I would also like to thank my university professors, who, with due diligence, kept me on the path to success through long nights of lectures, reading ethnography, theory, and writing précises. Many thanks go to my fellow students for the study sessions, writing support, and for the great conversations.

Special thanks go to the amazing thesis writing team that developed late in my project – Darci Arnold, Liz Ohlhausen, and Fiona Marshall. Many long days were spent at the Lime Tree Café, writing, editing, drinking coffee, eating bagels, and supporting each other through the logistics and mechanics of completing our degree programs.

Lastly, I would like to thank my family. After searching for the right words, there simply are none. My parents, Dave and Carol Toman; my husband, Raymond Gallardo; my son, Raymond Alexander Gallardo; and my brother, Scott Linn, I am eternally grateful for everything. Most of all, I will miss the weekly inquiries, "Are you working on it?" Your collective support, love, and motivation helped me see the light at the end of the tunnel.

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PROJECT DESCRIPTION

Introduction

Agriculture is the practice of intentional cultivation of plants and tending to domesticated animals for human benefit (Rhoades 2005:61). With a rich history, agriculture is increasingly complex with numerous stakeholders – e.g., producers, consumers, economics, and technology. However, agriculture's growing complexity places a great deal of pressure on natural resources. The need for farmers to maximize production is intensifying in order to fulfill increased demands for food, feed, fiber, and fuel for a growing population. The demand for these agricultural products in human societies constitutes a significant feature of an extended food system.

Food systems are complex and encompass numerous interdependent parts. Within food systems, agricultural systems are viewed as progressively more scientific, employing laboratory and field experimentation to maximize production and profit. The complexity of these interrelated parts and relationships, when combined, create a system that can be analyzed through systems science. Viewing food systems and agriculture from a meta-perspective, or a systems of systems perspective (Reckmeyer 2009:7-8), allows for the categorization of parts and strategic issues in order to appropriately appreciate pressing issues within the context of the larger whole.

In today's globalized world, people are increasingly unfamiliar with the origins of food, cultivation practices, and agricultural policies. Complex parts of food systems

range from social connections with food to broader features like food production, distribution, and consumption. Strategies to increase awareness of challenges to these systems would benefit from education campaigns as well as more integrated policies.

Project Focus

Framing agriculture as a system by focusing on its complex interconnected parts, strategic nature, and how to understand its critical relationships with other issues to produce food, feed, fiber, and fuel for a growing population was the foundation for the curricular project I conducted to complete my master's degree at San José State University. I used a systems perspective to create a college course that provides students with a working view of food systems and agriculture that categorizes strategic features and places them appropriately within the context of the whole. Those engaged in agriculture face a wide variety of challenges from environmental and logistical sources. By developing a systemic framework for people to better understand agricultural systems and the major factors that affect it, effective changes to the current system are possible through better education.

A key aspect of creating an educational course is the use of pedagogy, the science of instructional method, that is both relevant and useful to the particular curricular content. In addition to adopting a systems perspective, I used anthropological praxis for my major pedagogy because it is an applied teaching and learning mode that is both relevant and useful to the development of a course in anthropology and sustainable agriculture. While there are several definitions for praxis, a widely accepted one is that

of "translating knowledge into action" (Wulff and Fiske 1987). This was the most meaningful definition for the project because it has become increasingly important to disseminate information to a wide range of audiences. Additionally, it is increasingly important to provide a safe environment where students can learn to apply their knowledge in real-world settings, work in transdisciplinary teams, and think critically about possible solutions.

The use of a systems approach in combination with anthropological praxis can also foster changes in policies that strengthen the ability to ensure the safety and success of food systems and peoples' access to food throughout the globe. Looking at the diverse parts of the food system in this way allows for collaborative work to analyze multiple dimensions, domains, intersections, interconnections, and stakeholders. Through effective curriculum, there is an ability to systematically work toward solutions to goals that are based on common interests or needs. Mobilizing people through inclusive work is vital to producing necessary changes within a system to maintain its ongoing success.

Background

Demographic analysts predict the human population will reach nine billion by 2050 (Farm Foundation 2008). As a necessary element to sustain and enhance human life, food and agriculture are strategic human assets. Yet, agricultural production for a growing global population poses significant challenges in the decades to come (Farm Foundation 2008). The ability of farmers to produce sufficient food, feed, fiber, and fuel for a rapidly-expanding number of people will become increasingly difficult given

current global policies and practices. Innovative improvements in production and technological advances since the 1800s created a complex global agricultural system with extensive interconnected relationships to other complex systems. With evolving push-pull pressures from economics, energy, climate change, natural resources, and other key factors, however, the capacity to strengthen food production in order to fulfill the growing demands global population is increasingly daunting.

To move safely and effectively into the future, agriculture must become substantially more sustainable. Strategies to increase public awareness of global food distribution, as well as agricultural products in general are necessary. According to the United Nations' Food and Agriculture Organization (FAO), people residing in Low Income Food Deficit Countries (LIFDC) in 2007 had access to 32% fewer calories per capita per day than those in the United States (2010). In addition, most developing nations are very agriculturally dependent; agriculture in these nations represents more than 50% of the national GDP (CIA World Fact Book 2010).

Agricultural production in the United States and other technology-intensive nations, though, is at an all-time high. Crop yields are at their highest levels since 1944, primarily due to the dramatic improvements in productivity (Diouf 2007); yet their contribution to national GDPs is low, given opportunities in other more lucrative employment sectors. Agriculture is successful, but its overall role in the whole of a healthy nation, economy, and population is generally unappreciated. Nevertheless, damage to any aspect of these food production systems can interrupt humanity's ability to

feed people and livestock, disrupt food exports, and compromise the distribution of food aid. Because healthy agricultural systems are essential for healthy and secure populations, it is important to frame food systems in their entirety as strategic assets for countries in specific and for humanity in general.

Systems Thinking

Agricultural policies in any part of the world should not only protect food production and distribution from internal and external threats, but they should also ensure that people have reasonable access to safe, quality food. Systems science provides a rigorous approach for understanding the nature of complex interconnected phenomena, one that can view challenges and assets as parts of the overall food system. It enables people to recognize whole systems as well as to identify their critical major and minor parts, significant factors, patterns of behavior, and various inputs and outputs. It focuses on seeing these diverse systemic components in the context of internal and external relationships, rather than in viewing them isolation (Reckmeyer 1982; Checkland 1981; Kauffman 1980).

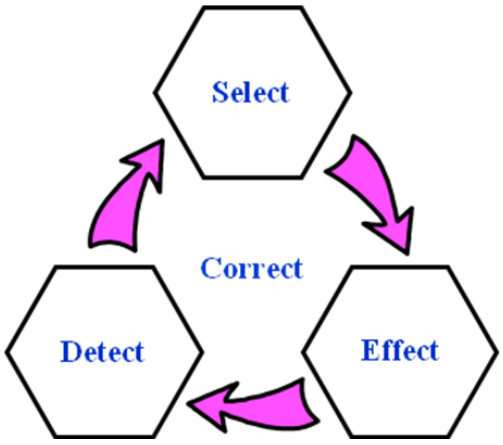
Cybernetics

A major field or discipline within systems science, cybernetics is especially critical to the formation of frameworks to better understand complex systems such as agriculture and work toward real-world solutions. Cybernetics is the general science of regulatory systems, information feedback loops, and purposeful goal-directed behavior (Reckmeyer 1982; Clemson 1984). The four principal elements of a basic cybernetic

model include detect, select, effect, and correct functions (Figure 1). The model begins with the identification (detection) of a problem or issue, followed by the choice (selection) of appropriate actions to resolve the issue, and finally the implementation (effect) of the actions. All the while, feedback is used to modify (correct) these elements to guide the system toward the desired goal and increases the chance of success (Reckmeyer 1982: 84-86).

People can use systems science and cybernetics to enhance leadership and develop more purposeful behavior to achieve shared goals that benefit the greater good. Incorporating systems thinking and cybernetics can help professors, practitioners, and policymakers craft a systemic picture that illuminates the interconnections among essential parts of food systems as wholes, understand the nature and the goal-directed behaviors characterizing the parts, and use this knowledge to navigate complicated real-world challenges while mobilizing key stakeholders (Reckmeyer 2009).

Figure 1
The Cybernetic Model



Food Systems

A food system is a hyper-complex set of numerous and varied parts that includes stakeholders, processes, materials, infrastructure, and products. As part of a greater food system, agriculture is the art, business, and science of producing crops, raising animals, and cultivating soil. The complexity of modern agriculture's interrelated parts and relationships makes it difficult to focus on any single part, though, and thus to predict what will happen to the whole system. Viewing food systems and agricultural systems through a systems perspective can help identify the pressing strategic issues that need significant attention within the context of the whole.

Addressing those issues in an integrated systemic fashion should enable us to improve such primary agricultural features as cultivation, distribution, and consumption. As humanity moves through the 21st century, the ability to produce ample quantities of food, feed, fiber and fuel for the entire global population is a paramount strategic priority. While agriculture appears to work well in many parts of the world, notably 1st-world countries, it has become undervalued and unappreciated in those regions. If taken for granted, however, significant problems are likely to occur. To rectify this growing myopia, it is vital to highlight the interdependent relationships between agriculture and society at large.

Some of the dichotomies within the food system include conventional versus organic foods, food production versus feed production, domestic versus foreign distribution, and small scale versus large scale operations. While there are numerous

parts to this system, it is a system that generally worked well on a global scale after WWII (Gliessman 2007:3). Unlike many other systems that are in need of immediate attention – such as those involving energy, declining natural resources, and climate change – agriculture is a system that is often ignored by the public and non-agricultural policy makers.

Improving global food systems requires that agriculture be framed as a critical and strategic asset because of humanity's basic food needs. While food access is vital to the survival and success of human societies everywhere, many people around the globe still face malnutrition and hunger. Current farming and food distribution practices in drought-sensitive and poverty-stricken areas continue yield insufficient harvestable quantities. An increase in crop yield may result in largely unsustainable practices. Improvements to agricultural policy can help alleviate this suffering (Gliessman 2007:16).

Individual connections to food production, distribution, and consumption are also vital parts of a food system. Strategies to increase awareness of these factors are possible through education and public awareness campaigns, as well as through the promotion of integrated policies. In today's globalized world, people who are increasingly unfamiliar with food origins, cultivation practices, and food preparation must reconnect with their food (Gliessman 2007:330). Connection to gardening and farming became compromised by the fast-paced, high stress nature of contemporary society since the emergence of industrial societies. Young people in urban areas have lost ties to the outdoors while

becoming increasingly attached to electronics. Also lost to urbanization and our increasingly technological society is the process by which a majority of food is grown in the United States. Modern farming operations typically rely on single-crop fields using increased amounts of chemically-based fertilizers and treatments. In addition, current production practices are consump-tion driven and place little emphasis on ensuring future production capabilities.

Agricultural Education

One central strategy to foster deeper awareness of food and food systems occurs with education. Through the process of learning and discovery, people gain practical and experiential investment in an issue. By means of widespread education campaigns, it may be possible to increase awareness of the issues and challenges involving food and food systems so they become more prominent in daily life. Articles and texts available for public consumption regarding the integrated nature and sustainability of policies and programs related to contemporary food systems can enhance public awareness too (Khanna 2009:194).

Since the onset of the Industrial Revolution during the 1800s, many industries became highly mechanized. This required more and more people to maintain and repair machines rather than specialized labor to accomplish tasks manually. These changes led to massive changes in social status through the growing need for skilled labor versus unskilled labor. Urban industries were not the only benefactors of such change, for agriculture was also profoundly impacted. Advances in machines and technology forever

changed industries that benefitted from these advances, but often with devastating consequences for society and the natural environment.

Walter Goldschmidt (1947) critiqued changes in the social status of farm workers and their exodus to urban centers as industrialization took over the rural scene through expansion and encroachment. After analyzing the effects of modern farming on rural populations, he emphasized the need for education campaigns to restore farming as a respected specialization in both urban and rural spaces. The emergence of professional-ized farm-labor employment could help stabilize agriculture by portraying farmers as capable, self-conscious, and self-respecting contributors to society (Goldschmidt 1947:275).

In addition to the need for social education campaigns to help farmers regain some of their lost power, Wes Jackson (1985) called for changes to be made in farming practices and policies. He proposed that farmers actively choose alternative crops and cultivate increasing numbers of perennials as a way to combat environmental and social consequences to modern farming. Perennials, as long-lived plants, have intricate root systems, increase soil stability, tend to be naturally more pest resistant, and require no synthetic inputs (Jackson 1985:106-107). Farming perennials decreases the cost to the farmer, allowing farmers to leverage financial resources they may not have previously had, thus increasing their social standing.

Education campaigns such as those described in Stephen R. Gliessman's *Agro-ecology: The Ecology of Sustainable Food Systems* (2007) provide in-depth examples of

what can be done. The primary focus of his book is to teach students about agriculture from an ecological perspective. The text is robust in focus and looks at the ground-level issues that farmers and consumers face, as well as at issues that are global in nature. Farming is practiced world-wide and the need for improvements in agricultural processes is global. In the face of economic uncertainty, unprecedented urban growth, and global inequities, the imbalances between developed and developing nations creates a threat to an already fragile global food system.

According to Gliessman, today's agriculture policies are rooted in economics and profits rather than shaped by ecological wisdom or future thinking (2007:16). Modern agriculture underscores the need to maximize production and profit. Understandably, it is fully supported by many national policies because it is quantity and profit driven. Alternately, we must keep in mind that in developing countries, maximum yield is paramount. Modern practices rely heavily on fossil fuels, chemical inputs, monocropping, and cultivating soil "completely, deeply, and regularly." These practices are unsustainable, unfortunately, because they epitomize the economic foundation of policy and regulation. These means of production cannot be relied upon to help meet the needs of a growing global population, which exceeded seven billion in 2013 (Gliessman 2007:16).

With significant decreases in renewable resources, changes in policies and practices are essential. Alternative agricultural practices, incorporating in-depth knowledge of ecological processes both in and around farm fields, make for more

sustainable practices. Agricultural sustainability embodies the ability of the system to renew itself or to be renewed by natural means in order to provide ongoing, bountiful food yields (Gliessman 2007:17). Moving forward, food systems must be both sustainable and high in yield in order to meet the food, feed, fiber, and fuel needs of a global world. Teaching future scientists to employ the science of agroecology, high yields using environmentally-sound practices may be accomplished (Gliessman 2007:18).

Finding a balance between traditional and modern systems of agriculture is difficult because the former cannot be directly transplanted into areas that employ modern practices – and vice versa (Gliessman 2007:301). Successful education campaigns will rely on the ability of applied professionals to isolate the best practices of different approaches and create a combined system using aspects of both traditional systems and modern scientific knowledge to generate more successful agricultural production (Altieri 1995:368; Gliessman 2007:299).

Project Influences

My interests in agricultural education and advancing public awareness of food systems stemmed from a wide variety of personal experiences and interactions with farms and gardens. Historically, my family has farmed and gardened in North America since the early 1500s. Having recent roots in the Midwest, I was raised with unlimited access to fresh foods from our bountiful home gardens. I helped prep, plant, and maintain those gardens as a child and became increasingly aware of where food came from through hands-on experience. For protein needs, several families in our community shared in the

expense of processing whole livestock. Families had deep freezers and stocked up on protein foods in bulk. Families were self-sufficient and relied on one another to supplement what they could not grow, instead of purchasing their food from retail establishments.

Regarding larger agricultural production, as a child I saw how the political nature of subsidies, corporate-based economics, top-down agricultural management, and decreasing environmental resources affected my family's farming operations. Land was frequently sold to larger landholders or corporations that tended to convert small-scale family farms into parcels of high-yield, technology-intensive single crop operations. While these challenges affect only some aspects of agriculture, they arise at local, state, national, and global levels, so strong leadership is needed to maintain this delicate system.

As the youngest member of my family to have strong ties to farming operations for six generations in rural Iowa, therefore, I have an intense emotional connection to the earth and to farming and gardening operations. Having the opportunity to grow up learning about nature and agriculture, I developed a deep connection to the environment and to food at a very young age. Gathering around a table of food, harvested earlier in the day, were daily events – not just on holidays and special occasions. Gardening, cooking, and eating were shared family values, passed down from generation to generation by mothers and grandmothers to their daughters and granddaughters. As the last granddaughter, I hold my family's legacy quite sacred.

My interest in this project also reflected my professional background as an educator. These interests stemmed from my concern over the loss of personal connection to the environment and to food in urban communities. For the past several years, I have served as an educator on local farms and in schools to foster relationships between young people and their local food systems. My farm curricula focused on introducing children and families to new ideas in urban farming and gardening, promoting healthy eating and outdoor activity, and strengthening family bonds through outdoor discovery. This master's project complements my background as a community educator quite nicely.

Project Approach

This master's project led to the development of a semester-long course, either in an undergraduate or a graduate setting, using integrated one- and two-week modules (Table 2) with a primary focus on globalization and sustainable food systems. I designed the modules so they could build on previous ones during the entire course or be presented individually on a stand-alone basis at professional seminars, weekend seminars, or other workshops.

My purpose in developing this course was to provide an academic environment for broadening students' ability to examine complex issues using a framework rooted in anthropology and systems science. Using systems science as the platform to set the context for the course, students can use the semester to explore a wide range of issues within the agricultural system, as well as the influential external systems that help shape it. Furthermore, they will be exposed to the basic concepts and features of agriculture,

food systems, sustainability, globalization, and global citizenship. A course such as this can be a point of departure for students to master area-specific material and also to learn a variety of skills such as communication, teamwork, and leadership. They will also develop an ability to conceptualize complex issues using systems science and to work through solutions-based actions using the cybernetic model.

The relevance of such a course to an academic department like the Department of Anthropology at San José State University is that it complements a number of existing courses by broadening the curricular options of the department. Its contribution to the discipline of anthropology lies in its ability to educate students about important current issues, rooted in the framework of anthropology and systems science, in such a way that students are able to visualize real-world situations and use the classroom environment to learn to effectively brainstorm and navigate solutions.

Contemporary anthropology is a field in which we must begin to teach ourselves to look at current issues through the lens of an anthropologist. The days of primarily studying foreign and exotic cultures are behind us with a rapidly-globalizing population. Anthropologists are assets to teams of diverse experts, willing and able to work together toward common goals for the greater good. More likely than not, anthropology will become an increasingly applied field, thus requiring students to be able to immediately contribute to systemic evaluation and co-creation of solutions upon graduation from higher education.

My project curriculum focuses on leveraging agricultural education as a means to raise awareness about agriculture as a strategic asset for a globalized world. Developing such a curriculum must encompass both the strategic nature and the strategic importance of agriculture in building a more sustainable global society. Agriculture as a system has numerous integrated parts and it is critical to begin to identify the interrelations to other systems in food, feed, fiber, and fuel production for a growing population. Today, those engaged in agriculture face a wide variety of challenges from economic, environmental, and social sources. Through the development of a systemic framework to better understand agricultural systems and the major factors that affect it, effective changes to the current system are possible.

Conclusion

The primary focus of this project was to deepen the understanding of agriculture as a system and agriculture's strategic role in human success through the creation of a university-level elective course. Central to such a project was my interest in student development. Through identifying techniques to better understand the relationships and the critical crossroads between agriculture and related issues in food, feed, fiber, and fuel production, students emerge better prepared to navigate life's challenges as well as join teams of applied professionals who are working toward solutions to real world problems.

While a generally-understood purpose in higher education is to build human capital, sometimes it is more important to build social capital. Educating people about agriculture as a system and its complex interrelated issues is not fundamentally about

providing knowledge to be applied toward future employment – it is about cultivating knowledge and meaningful investment in a sustainable and globalized future.

CHAPTER 2

PROJECT IMPLEMENTATION

Introduction

During the past several years, I dedicated myself to creating curricula for a wide variety of general audiences in farming and gardening. I found that putting together a structured learning process was most rewarding when 'ah-ha' moments occurred. These moments fostered a desire to take curriculum development and teaching to a more advanced level through the creation of a university-level course, which was the purpose of my master's project. After identifying foundational works on which to base the course, I worked to better understand academic teaching methods, pedagogy, praxis, and the overall structure of higher education courses. My project research helped inform each of these aspects as well as the learning outcomes, activities, instructional design, and module development of the course.

Goals

My decision to develop an academic course in agricultural policies and practices grew out of my interest in an emerging body of integrated knowledge about food, feed, fiber, and fuel. I believe that courses designed to cultivate knowledge of real world challenges and the application of newfound knowledge to real-world solutions in professional settings is critical to student development. This project resulted in such a course, one that is appropriate for university and professional environments. Drawing upon knowledge and insights from agriculture, systems science, and anthropology, it

consists of ten integrated modules with a primary focus on globalization and a sustainable future for our food system.

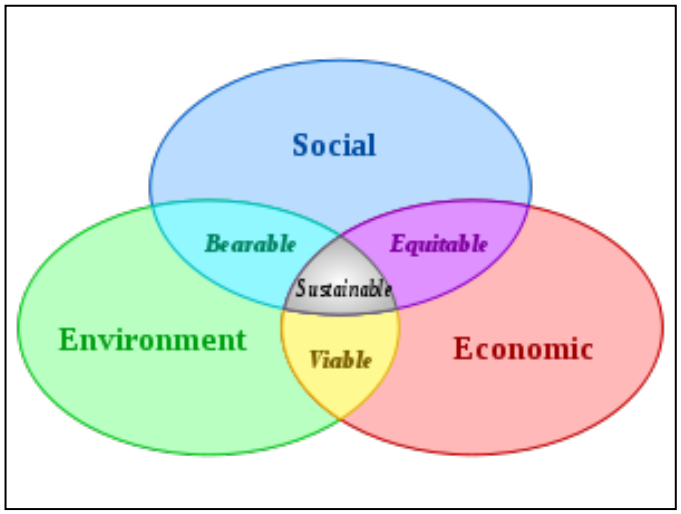
My goal in creating this course was to address a simple, but urgent and complex question: how do we feed and fuel a growing population in a sustainable way? The platform for the course was inspired by two major works that reflect a deep-rooted need for modifying how change is made and how policy is implemented. At the center of my project was the idea of change – primarily in terms of how knowledge about agriculture and food issues is identified, addressed, and disseminated. The first document was the Brundtland Report (1987), which called for the creation of a more sustainable world through integrated policies using the Sustainable Development Model as a common framework. The second document was a report by the Farm Foundation, The 30-Year Challenge (2008), which described the major systems affecting agriculture (including economics, energy climate, and natural resources) and called for actions to develop a more sustainable agriculture system. These two sources were used as the principal bases for developing my course on sustainable agriculture.

Brundtland Report | *Our Common Future*

The World Commission on Environment and Development was convened in 1983 at the request of the UN Secretary General, Javier Pérez de Cuéllar. The commission later took on the name of its chairwoman, Gro Harlem Brundtland (former Norwegian Prime Minister), and is now widely known as the Brundtland Commission. After four years of research and policy analysis, the Commission published its report *Our Common*

Future 1987. The major result of this publication was its formulation of the Sustainable Development Model, which underscored – for the first time – the need to include environmental, economic, and social elements under the same umbrella in the context of policy creation. The Commission's goal was to simultaneously advance each of these pillars so people across the globe can lead healthy and productive lives for generations to come (Brundtland Report 1987).

Figure 2
The Sustainable Development Model



Farm Foundation Report | *The 30-Year Challenge*

The Farm Foundation's report, *The 30-Year Challenge | Agriculture's Strategic Role in Feeding and Fueling a Growing World,* highlights the need to successfully provide agricultural staples for a growing global population. The need for food, feed, fiber, and fuel for 9 billion people by 2040 may become significantly more difficult as policy makers and practitioners grapple with hyper-complex, interrelated challenges in

the context of global economics, food security, energy security, climate change, and natural resources. Using these primary influential systems as a point of departure, it emphasized how to better understand and improve weak and failing aspects in agricultural policy and practice.

This report was designed to be a call for action based on the findings of a broad group of professionals in the field – policy makers, academics, and government officials. They focused on a set of six interrelated categories related to agricultural production: Global Finance Markets and Recession, Global Food Security, Global Energy Security, Climate Change, Competition for Natural Resources, and Global Economic Development (Farm Foundation 2008). Threaded through each of these categories were eight cross-cutting themes: general uncertainty; public understanding; unintended consequences; trade-offs; research and development; infrastructure; trade; and most importantly, the absence of a clear integrated strategy for U.S. agriculture.

Project Plan

Prior to embarking on this project, I wanted to ensure that it would contribute a useful source of material to the existing body of knowledge on agriculture and its major challenges. To better understand the context for such a course, I reviewed several university websites as well as a great deal of literature. In doing so, it became clear that not only was material rooted in agriculture, systems science, and anthropology rare, but also that there are very few connections between the disciplines in university courses or in available literature.

Developing course curricula requires a great deal of research in terms of structure, length, accreditation requirements, and content. The data collection methods I used for this project included in-depth literature reviews of academic publications, journals, books, websites, courses, newspapers, and published reports. The material was gathered online, in libraries, and from my own personal collections.

I focused on literature relevant to the content areas being addressed in the ten modules of the course. In addition to data from the Farm Foundation's *30-Year Challenge* (2008) and *Our Common Future* (1987), the literature I reviewed included texts rooted in ethnography, environmental studies, social science theory, agricultural history, agricultural methodologies, and the current situation in agriculture. Finally, I conducted research to identify the necessary elements for planning and designing higher education curricula in general.

Emergent Fieldwork

The fieldwork that informed this project is reflected my academic and professional background as an anthropologist and an educator and can be describes as agricultural anthropology. My work was informed and influenced by my work with multiple non-profit organizations. As described in Robert E. Rhoades *Agricultural Anthropology*, my work was ecologically informed and I placed emphasis on process flow, technology, and systems analysis, both traditional as well as contemporary (Rhoades 2005:67).

Academically, I worked with Dr. Reckmeyer as a teaching assistant for the California Agricultural Leadership Foundation (CALF), and attended the Global Citizenship Program at the Salzburg Global Seminar (SGS) as a Salzburg Global Fellow. In these nontraditional learning venues, I was sensitized to issues that needed to be in the classroom as I was exposed to and interacted with Fellows who were aware of issues within agriculture, but were not systems experts. It was here that I began to see what people knew and what they did not know. While a teaching assistant to Dr. Reckmeyer for CALF, I attended seminars and social events where discussions took place formally and informally regarding the challenges of agriculture within California. As the CALF Fellows were California-based agricultural professionals, their conversations and discoveries were very different than those between Fellows at the SGS in Salzburg, Austria.

As that assistantship was drawing to a close, I was chosen to serve as an SJSU Salzburg Scholar in a highly selective 18-month program to help globalize the university (http://www.sjsu.edu/salzburg). Part of my responsibilities included attending a weeklong student session of the International Study Program on Global Citizenship (ISP) at the Salzburg Global Seminar in Salzburg, Austria to broaden my understanding of global issues and to develop my leadership skills. In this venue, I was a participating Fellow working alongside other attendees from around the United States, all with very different foci and academic specialties. Here, the level of knowledge regarding agriculture and its challenges was basic, but many were open to learning more about the

issues. That experience also reinforced my knowledge of systems science, cybernetics, and globalization as they relate to agriculture and the need to change how polices are made using higher education as the vehicle. I found that moving out of our comfort zones and into a hyper-complex learning environment was life-changing for me and many students in Salzburg. This was a key element in reinforcing my desire to create curricula for more globally-minded and goal-driven students. As a participant and an anthropologist, I used these academic experiences to inform how I was going to reframe and disseminate information about food systems and agriculture.

Professionally, my interests stemmed from my concern over the loss of personal connection to the environment and to food in urban communities. In Santa Clara County, I contributed to the startup operations of two successful non-profit organizations: Full Circle Farm in Sunnyvale and Veggielution Community Farm in San Jose. Having a several years of farm-based teaching experience, I developed courses for middle-school students, created community programming, conducted educational tours, and planned and executed education-based events. With a team of five education staff and 10-12 education volunteers, we developed, piloted, and taught courses for over 600 students in the 6^{th}, 7^{th}, and 8^{th} grades; special education; and continuing education. Each student had a minimum of one-hour of garden instruction per week for 16 weeks. The education model we used was similar to that of this project, in that weekly instruction was designed to build on previous weeks and prior knowledge. Additionally, as students graduated into the next grade, their time and responsibilities in and around the garden increased. This

model is still at work today as the organization grows and continues providing excellent complementary education to students while also strengthening their relationship with the Santa Clara Independent School District.

While I was the education director at Full Circle Farm, I was also invited to be a founding board member of the Veggielution Community Farm. This organization was founded by SJSU students engaged in backyard gardening who soon became stewards of eight acres of city land at Emma Prusch Agricultural Park in San Jose. Veggielution has the unique opportunity to provide a fresh food access point to those in a low-income, multi-ethnic neighborhood in southeast San Jose. The group offers community-oriented education programs with a focus on afterschool apprenticeships for local high school students as well as for families with children. As a board member, I was able to influence the development of the education department and was able to teach several community classes that I developed (Home Cultivation of Culinary Mushrooms, Gardening with Preschoolers, Homemade Mozzarella Cheese Making- Appendices D,E,F), as well as assist in teaching and mentoring volunteers in the farm fields.

Through opportunities provided by professors and mentors and experiences gained as a member of local agricultural non-profits organizations, I was able to use my knowledge in emergent and participatory fieldwork to better understand peoples' cognitive frameworks regarding food and food systems. It was important to frame the course material and desired outcomes to reflect what I discovered about peoples' knowledge and assumptions about food and food systems. Through these combined

experiences, I was able to hear the different languages people spoke when they began to learn about framing food systems and agriculture as a system. Using a simple set of questions – what do people know, what do they need to know, and understanding what they knew they needed to know – set the tone for developing a course appropriate for multiple settings in a variety of local communities.

In conclusion to *Agricultural Anthropology*, Rhoades suggests there are several key steps to move agriculture forward in the field of anthropology as we face growing populations and pressures on food systems and global economic stability. Of his five suggestions, my fieldwork and goals for this project can be applied to at least four. First, he states anthropology must be disseminated beyond its traditional boundaries. For effective changes in ideology, agricultural anthropology writing and presentations must reach the public sphere. Second, anthropological training must include that of policy and practice outside of university settings. Third, anthropologists must build ties with agricultural scientists and organizations. Lastly, agricultural anthropology must be strong in both theoretical anthropology and applied practice (Rhoades 2005:81-83).

Practical Learning: Transdisciplinary Approach

In order to better understand the complexity involved in feeding and fueling our growing global population, I used a transdisciplinary approach based on agriculture, systems science and anthropology. This approach helped me paint a holistic portrait of modern agriculture as a complex system. Utilizing these three lenses, I was able to triangulate the issues facing agriculture in order to develop solutions to its challenges.

Triangulation for purpose of this project includes repeating questions, discussions, and research on the same topics using different disciplinary approaches (LeCompte and Schensul 1999:90). Identifying issues and proposing solutions through the three lenses provided a richer analysis that is better suited for integrated policy.

In addition to triangulation, the interdisciplinary portrait of agriculture can be understood using a systems approach – understanding linkages and relationships between its parts and influencers. Engaging in interdisciplinary systemic practice is wholly beneficial in that teams may be formed employing individual contributions based on relevant expertise. A transdisciplinary approach is potentially even more powerful and useful for addressing agricultural issues because it relies on teams that engage equally in analysis and solutions, regardless of their expertise. This practice lends itself to increased flexibility, deeper perspective, and shared responsibility and risk among those making decisions (Zeisel 2006:77-78).

Course Objectives and Learning Outcomes

Carnegie Mellon University describes Learning Objectives or Course Objectives as knowledge and skills that students should demonstrate by the end of the course. Course objectives help the instructor select and organize course content, determine appropriate assessments and instructional strategies, and help students direct their learning efforts and monitor their own progress. These objectives should be student focused, break specific tasks down, and emphasize cognitive processes (Carnegie Mellon 2010). Course objectives are best utilized when triangulated with course assessments and

instructional strategies, while employing the cybernetic model allows for better alignment of each core aspect in developing a successful higher education course (Carnegie Mellon 2010).

Students are increasingly seen by many people in society at large as customers, however, rather than as beneficiaries of knowledge and skills. Learning outcomes are meant to describe what higher education should be preparing students to do. They are essentially ways to measure learning and are intended to reflect how credit is earned through course work (Otter 1995:273). Learning outcomes are also useful to students. When included in course syllabi, they highlight information that is important to student success in the course. This provides them with a better understanding of what the course intends to teach beyond the course content. Higher education is a place to explore critical thinking, problem solving, and other employment-critical skills (Otter 1995:273).

The learning outcomes I created for this course are in line with those adopted by the Department of Anthropology (http://www.sjsu.edu/anthropology/) at San José State University. This course is intended to assist students in developing a coherent framework for examining the interaction of complex issues and working with others to make the world a better place. Key learning outcomes reflect cognitive domains in educational outcomes such as gaining general knowledge, comprehension, application, analysis, synthesis, and evaluation (SJSU 2010):

- an understanding of the nature and practice of agriculture in a complex world
- a broad sense of agriculture as an interconnected whole, including the impact of major key issues that affect it such as economics, security, and energy, and natural resources

- an idea of need to view agriculture as a strategic issue as it directly impacts human society and the planet's natural environment
- an advanced competency in upper-division intellectual and practical skills needed for strategic analysis, critical thinking, written and oral communication, information literacy, interdisciplinary teamwork, and systemic problem-solving
- an ability to apply the knowledge, skills, and responsibilities learned in this course to work with diverse sets of stakeholders on complicated issues in new settings

Students will demonstrate the ability to achieve these course learning outcomes (CLOs) through interactions with fellow students, topic papers, presentations, and exams.

As the job market evolves due to changes in our economy, globally as well as locally, students must become increasingly versatile. This means that higher education must place more emphasis on teaching teamwork, communication, professional and personal responsibility, initiative, and achievement (Otter 1995:282-283). Students successfully completing this course will be empowered to become more effective change agents in a complex globalized world.

Course Activities

The activities I chose for this course were selected to maximize students' efforts in learning complex material in a short amount of time. Designed as an overview course, my intention was to offer students a wide range of ideas, connections, challenges – and a framework to process it all. To ensure that course content flowed and was digestible for students with no prior background, I utilized instructional design, assignments, reading lists, and course activities based on active and participatory learning. The two primary assignments in this course include a food autobiography (Appendix B) and a semester-long team project (Appendix C).

The food autobiography, due early in the course, is an individual writing assignment developed to addresses student's own backgrounds with food and food systems. It includes three major sections. The first section asks students to describe a specific example of a food story (either positive or negative) that they have personally experienced at school, at work, or in another setting (such as traveling or visiting others). The second section outlines and clarifies any lessons learned from that experience, in terms of its impact on personal views of food and food systems. The third section summarizes the student's broader views about agriculture and food in general, in terms of a basic definition and those features they find most significant. The purpose of this assignment is to prime students to think more critically about food and food systems as they relate to personal stories, memories, and outcomes.

The semester-long team project is an on-going project based on research of increasingly complex agricultural subject matter affecting the world in different ways. Students will present their research in three segments throughout the course that focus on regional analysis, strategic challenges, and regional strategies. This activity is intended to help students develop a better appreciation of critical issues facing agriculture and its related systems in a global setting. Ideally, they will start to develop systemic strategies for improving the key issues at hand, by comparing the situations in several different regions of the world.

There are also additional reading assignments relevant to the course modules that will be assigned prior to lectures, after which students will have the opportunity to

discuss material, think about and answer critical discussion questions, and ask questions to clarify information.

Instructional Design

Planning and designing a course fit for upper-division undergraduates or as a graduate elective requires the development of a meaningful template. After researching best practices around the country, based on an extensive review of course development literature in higher education (SJSU 2010), I used instructional design elements outlined by Carnegie Mellon (Table 1) to create an appropriate layout for this material. Of the eight listed activities, I chose six strategies most applicable to promoting the successful achievement of the CLOs.

For weekly class meetings, I included integrative lectures using PowerPoint presentations, discussion activities to facilitate collaborative learning, and written assignments to promote knowledge application. Semester projects include collaborative group work, presentations with public review and evaluation, and written papers. Midterm and Final course assessments include written reflections. Ironically, Carnegie Mellon does not explicitly mention reading assignments. While it does mention case studies, which are usually text-based, additional reading materials are also necessary to achieve the course objectives and learning outcomes. Reading assignments are included in this course as an essential aspect of weekly classes as well as semester projects and assessments.

Module Development

The course consists ten of substantive modules based on the Farm Foundation's Report (2008). Each module was designed to be presented in two weekly segments,

Table 1
Instructional Design Elements

Activity	Purpose
Lectures	Information dissemination; bridge knowledge gaps; promote deeper connections to course material; further engage students.
Discussions	Experience with evaluating positions, thinking through and articulating an argument; defending positions; and identifying problems, inconsistencies, or conflicts within an argument.
Case Studies	Promote active learning, critically think through ethics, disciplinary methodologies; apply academic knowledge to real world issues.
Writing	Build relationships between ideas; practice of conventional disciplinary writing formats; development of analysis, synthesis, and reflection of ideas.
Labs/Studios	Develop disciplinary and process skills; receive immediate feedback and learn to respond to it; develop meta-cognitive skills; gain hands-on experience in developing tools and techniques.
Group Projects	Compare and contrast data and case studies; develop high level cognitive and meta-cognitive skills; promote evaluation, analysis, synthesis of issues; practice leadership, communication, problem solving, and conflict resolution.
Recitations	In-depth material review, public speaking, identification of problems in arguments, individualized feedback.
Public Review	Practice with evaluation; providing feedback; responding to feedback; strengthening arguments; self-reflection.

during day or evening class periods and is summarized in more detail in Chapter 3. Over the course of a 16-week semester, which is typical at San José State University and other higher educational institutions in the United States that operate on a semester rather than a quarter basis, these ten modules were prepared with time allotted for other course requirements such as a general course introduction, in-depth discussion and clarification, testing, presentations, and a semester wrap-up. The course schedule also includes breaks, holidays, and other academic calendar events.

Conclusion

Based on an increasing concern about humanity's ability to produce ample food, feed, fiber, and fuel products for a growing global population, there is a demonstrable need for additional research and education to enable agricultural sustainability (Farm Foundation 2008). This would provide a strong foundation for the future development and success of agricultural policies and programs that are tailored to meet the needs of local communities in the United States as well as for other sovereign nations and their diverse communities. The shift in education and policy creation must be directed at rebuilding the fundamental interconnectedness of people and the natural environment in both an economic and a social context (Brundtland Report 1987).

CHAPTER 3

PROJECT RESULTS

Introduction

After three years of study, design, and development, the final outcome of my project was a robust transdisciplinary undergraduate course that introduces students to agriculture and the primary systems that directly influence it. Because relevant literature and research material specific to the focus of this course was relatively thin, I drew upon the disciplines of agriculture, systems science, and anthropology to create a framework that makes substantive sense and is also teachable to others. The disciplines I chose to include are rich in general literature addressing such topics as current issues, policies, practices, and challenges on both a national and a global basis. This chapter summarizes the modules that constitute the content of the course.

Course Modules

Using the Farm Foundation's *30-Year Challenge* as a template, I designed the ten modules of the course (Table 2) to build upon one another in increasing complexity. Each module follows a similar structure to provide students consistency to ease the digesting of complex new information. The modules include complete written material, as well as detailed outlines that accompany PowerPoint slides. Each chapter, including the outlines and slides, can be used as course presentations or professional presentations. The written chapters, if used alone, can be adaptable to article or journal submissions, as well as professional or academic writing samples.

Table 2
Course Modules

Module	Topic
1	Introduction to Sustainable Agriculture
2	Agriculture as a System
3	Current Situation in Agriculture
4	Agriculture and Global Economics
5	Agriculture and Food Security
6	Agriculture and Energy Security
7	Agriculture and Climate Change
8	Agriculture and the Environment
9	Agriculture and Global Economic Development
10	Agriculture as an Integrated Strategic Asset

I intentionally created the modules to reach different audiences, so the curriculum is distinctive in that is applicable and relevant to a wide range of people. The course in its entirety is appropriate for university students in a variety of disciplines – including agriculture, anthropology, business, environmental sciences, global studies, political science, and systems science. Modules can also be presented individually to institutional audiences – such as those in professional associations, foundations, public benefit groups, educational organizations, and government agencies. The material is also designed to be accessible by the general public, in that the material is relevant for academic as well as

popular publications. Structurally, the models follow the same format. Each begins with a section introduction, the current situation within the interrelated system, effects of the interrelated system on agriculture, where we want to go tomorrow, and the triple bottom line of any new future policy using the Sustainable Development Model.

Module 1 | Introduction to Sustainable Agriculture

This is the introductory module of the course. As you can see in the Course Syllabus (Appendix A), it is presented over a one-week time period to provide students with a summary opening look at "Humans and Agriculture". Threading together the interrelated parts of agriculture through an historical exploration of agriculture's origins provides an important chronological context for the course.

Understanding the historical evolution of domestication and cultivation practices, from a cultural and social perspective, provides a necessary context for fostering changes in how modern society prioritizes food and food systems. The evolution of humans and their relationship to agriculture and food includes hunting and gathering, horticulture and gardening, and farming. Primarily using anthropological texts, this module explores the relationships between humans and food systems from the onset of intentional plantings. Over time, as human society became increasingly complex, so did their food systems.

Ecology is a critical component to the discussion of contemporary sustainability and food systems. It is widely understood that plant manipulation for the purposes of food, fiber, and fuel by humans was due to population pressures (Bennett 1973:36; Flannery 1973:283-284). As humans populated six of the seven continents and climates

improved from the end of the Pleistocene period, carrying capacity of the land began to wane. With diminished carrying city of the land, unintended consequences negatively affected soil, water, and other natural resources (Nichols 1987:598). Through the archaeological record, anthropologists are able to ascertain the successes and challenges of ancient peoples (Peregrine et al. 2004:145). Understanding these relationships between humans, the environment, and food systems have a direct impact on the understanding we have of contemporary sustainability.

The history of humans and their relationship to their food system is hyper-complex and complicated. While the course content is more robust and works through the process of humans and food systems in a methodical manner, for the purpose of developing content for this report, I chose to make this section accessible to a wide range of readers.

History of Food Systems

As humans emerged from the late Pleistocene, about 10,000 years ago, temperate climates became ideal environments for planting and growing various types of grasses. Over the next several thousand years, humans learned to harness environmental resources and began the domestication process of various cereal grains, vegetables, and animals (Fuller 2007; Smith 2001:1324-1326). Various types of cultivation and agriculture rose from primitive plant manipulation including seed-crop cultivation and vegeculture in a wide range of climates and landscapes at relatively the same time, geologically speaking

(Peregrine; Flannery 1973:273). In conjunction with crop domestication events, animal domestication events occurred around the globe (Table 3).

Hunting and Gathering

Hunting and gathering, as defined by Julian Steward (1972), was a successful adaptation of early human culture and behavior to the natural environment (Steward 1972:38-39). Hunter-gather societies were subsistence based and hunted, fished, and collected only what was necessary for day-to-day food requirements. Tools were simple, hand-made instruments for hunting and fishing, gathering and storing collected foods, and also included basic canoes, sleds, and other transportation means, water and fuel storage, and clothing (Steward 1972:40). Humans depended on the environment to provide food staples and material culture, had a deep connection to the land, and used available resources only as necessary.

Shifting Cultivation and Terracing Agriculture

During the Neolithic Revolution, new foodways emerged with the intentional production of cereal grains and use of domesticated animals. With widespread domestication of crop staples and development of cropping methodologies, cultivated food plots allowed for nomadic and semi-nomadic groups to settle into areas conducive to controlled plant production. Primitive cultivation evolved into horticulture, or garden cultivation. Common forms of early horticulture include shifting and terracing. Shifting cultivation was an adaptive strategy that incorporated the existing structural and natural

environment creating systemic congruity between the biotic communities of manmade gardens and the existing undomesticated ecosystem (Geertz 1970:16).

Subsistence Gardening

Another critical step in the evolution to modern agriculture occurred with the emergence of subsistence gardening. The Trobriand Islanders, for example, cultivated crops with passion that was instilled in them through cultural systems and traditional values passed from generation to generation. Their social, political, spiritual, and economic lives revolved around the successes of their gardens and the wise use of the natural resources available to them (Malinowski 1935:82-83). Trobriand gardening was based on seasonal rhythms. There was a timely order to everything and members were responsible for contributions to the community (Malinowski 1935:157). As the success of larger gardens and cultivated plots grew, so did local populations. This was important because population growth was the basis for technological discoveries that led to the development of large-scale farming.

Table 3
Plant and Animal Domestication

Period	Developments
10,000 Years Ago	Barley and Wheat (Middle East) Squash (Mexico)
8,000 Years Ago	Goats and Sheep (Middle East) Pigs (Asia)
6,000 Years Ago	Cows (Middle East), Legumes (Near East) Maize/Corn (Mexico) Sorghum (Africa)

4,000 Years Ago	Millet (South Asia) Water Buffalo (China)
3,500 Years Ago	Chickens (Asia)
3,000 Years Ago	Rice (China) Llama (Peru)
2,500 Years Ago	Bactrian Camel (Central Asia) Dromedary Camel (Arabia)
2,000 Years Ago	Beans (Mexico) Pearl Millet (Africa)

Subsistence Farming

A more extensive mode of subsistence agriculture provided even greater benefits for larger groups of people around the world. One example is the Zapotec culture in the Northern Sierra of Oaxaca, Mexico. Archeological evidence suggests that maize was domesticated from the native grass, *teosinte*, around 6,000 BCE in the fertile valleys of central Mexico and has been cultivated as a food crop (along with beans and squash) in this region for thousands of years (Gonzalez 2001:118). While the Zapotec and other indigenous farmers worldwide devised viable systems of agriculture, just as Indonesians have done with wet rice farming, modern scientists still have difficulty understanding the complexity and even the successes of such systems.

Zapotec farming traditions include methodologies such as intercropping, crop rotations, and composting consistent with ecologically sound practices (Gonzalez 2001:167). Not until the 20th century were chemical fertilizers, pesticides, and other means of modern agriculture introduced (Gonzalez 2001:169-170). Nevertheless, these

subsistence forms of agriculture were able to satisfy the food needs of a given community for millennia. As methodologies and practices expanded in technology and complexity, so did community populations. The rapid increases in population led to changes in land use, politics, and social dynamics. Urban centers rose out of small sedentary settlements and foodways continued to evolve, with the result that subsistence agriculture gave rise to commodity farming.

Industrial Revolution

The bulk of the human population was sustained by agriculture, although many cultures remained part or fulltime foragers. Localized food production, which had been sustainable for most of human history – even if precariously – changed profoundly as it was altered by craft specialization and capital-intensive economies. These changes triggered a significant increase in the overall productivity and availability of foodstuffs around the world, but they also led to a decrease in self-sufficient homesteads and pushed communities in the advanced countries toward relying on a handful of producers to meet their food needs. With the onset of specialized economic systems, particularly with the emergence of the global world since the end of World War II, people have grown increasingly distant from their food sources. As societies modernized, agriculture has become a specialty craft requiring regulation and oversight rather than as the primary social and economic basis for human communities.

Module 2 | Agriculture as a System

This module examines how globalization affects social, political, and economic factors of communities with concrete benefits and conflicts. Agriculture in modern times developed new dimensions through globalization, which refers to the process by which regional economies, societies, and cultures have become integrated worldwide networks of communication, transportation, and trade. Globalization is characterized by the flow of markets, materials, people, and ideas; yet globalization is also characterized by disjuncture. In a globalized world, disjunction leads to dichotomy. This is apparent when analyzing the interconnections between developed and underdeveloped nations, haves and have-nots, modern and traditional societies, and the local and global (Appadurai 2000:17; Reckmeyer 2009).

Those who support the process of globalization point to increases in financial opportunities, democratic and humanitarian movements, access to education, increased living standards, and access to technology and progress (Adams and Carfagna 2006:24). Those who oppose globalization express concerns about people who are left behind, exploitation, environmental abuses, and loss of local cultures (Adams and Carfagna 2006:25). One critical intersection where globalization has a great deal of impact is the natural environment. As societies become increasingly interwoven, pressures on the environment grow. The human population reached 7 billion in 2012, a size that is creating enormous demands on water, land, air, and various natural resources. A great deal of pressure will also come from increased food production and distribution needs.

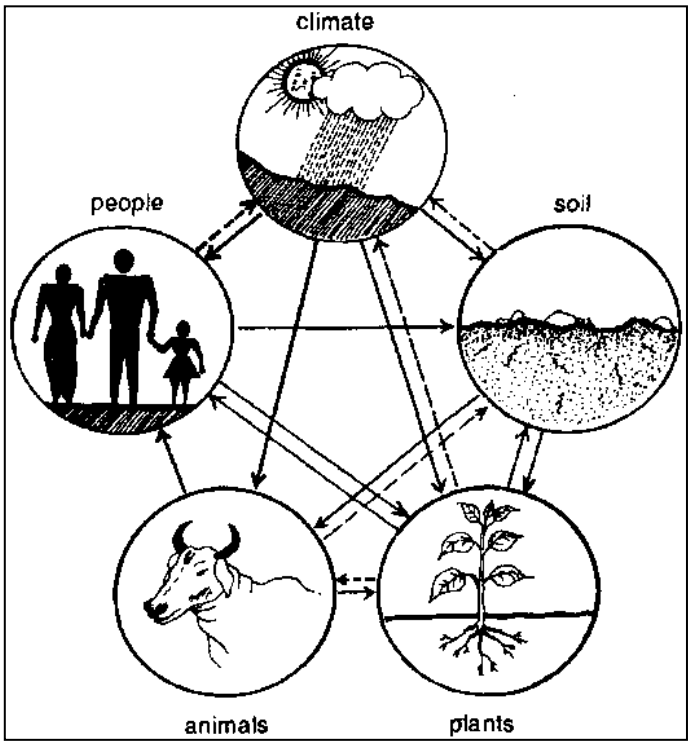
With 20% of the world's population currently at risk from the adverse effects of too few resources or polluted resources, changes must be made to protect human beings from a disastrous future (Adams and Carfagna 2006:38-39).

The sizable risks associated with these environmental demands raise serious concerns about humanity's ability to produce sufficient crops to feed and fuel a growing population. Agriculture is one of many systems affected by the process of globalization, open to a great deal of external influence by numerous complex environmental, social, and economic issues. The ability to understand agriculture as a hyper-complex system relies on it being framed from an ecological perspective, taking into consideration a broad triangulated spectrum of food-related issues.

Systems science and cybernetics can help create a road map of sorts to better understand the complexity of agriculture and factors that affect it as well as broader aspects of sustainability (Stowall et al. 1997). Generally speaking, systems are sets of interacting parts and relationships, structures and processes, and causes and effects that create integrated wholes (Reckmeyer 2009). Complex systems are characterized by the existence of emergent properties, both structural and behavioral, flowing from their internal and external interconnectivity with other systems (Reckmeyer 2009). Using systems thinking makes it easier for people to identify the boundaries of complicated phenomena like agriculture and thereby understood it within the context of a globalized world (Dixon et al 2001:254; Reckmeyer 2009).

Systems models are conceptual, visual, virtual, or physical representations of phenomena that highlight the parts and relationships of systems as well as how they change over time. These models can be simple or complex, depending on the nature of what is being modeled and how rich a picture is desired, with increasing levels of detail as the various elements of a system are unpacked. The most basic parts of agricultural systems include soil, climate, people, plants and animals (Figure 3).

Figure 3
A Simple Agricultural System

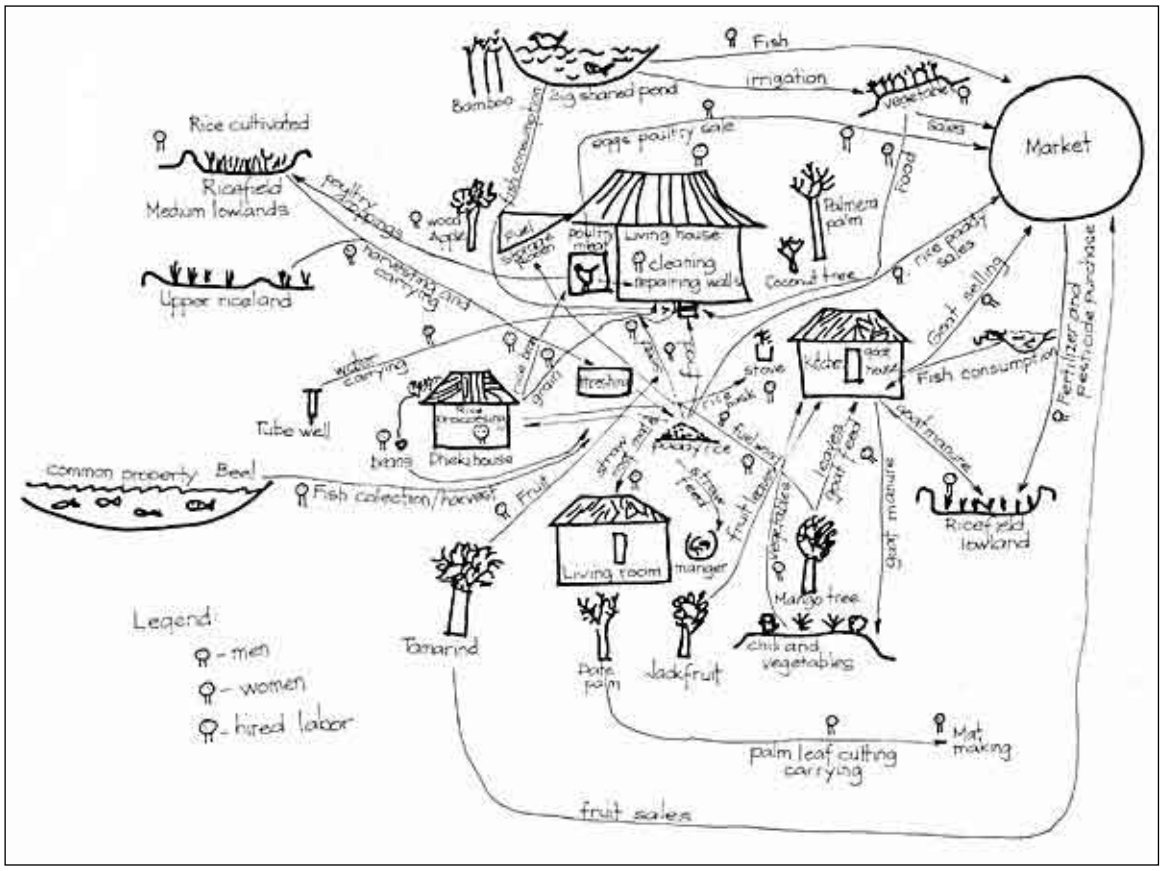


More complex systems models of agriculture would depict the range of relationships between individuals, community members, gardens and farm plots,

pastures, water sources, storage, transportation, natural resources, and market places (Figure 4).

Figure 4

A Bangladesh Farmer's View of a Farm System



Using the cybernetic model, one can follow the flow and trends of agricultural production, product distribution, and consumption. This allows for challenges to be more easily identified, corrections made to the system, and goals to be met.

Module 3 | Current Situation in Agriculture

This module includes material on the "Current State of Agriculture", the "Big Debate", and "A Better Agricultural System". It is intended to be presented over a three-week period. This module provides students with an integral look at modern agriculture from both a global and a local perspective, the opposing viewpoints of farmers and advocates, and suggestions for an integrated agricultural model, drawing insights from the best practices of various farming philosophies.

Globalization has drastically changed the physical landscape, causing food systems to experience significant alterations and culturally-based changes. The introduction of machinery and mechanized processes during the Industrial Revolution opened the doors to innovation and technological expansion. Prior to the onset of machines and factories, agriculture was primarily carried out through human and animal labor on a small, localized scale. Communities were unified by agricultural as a cultural centerpiece and residents maintained a connection with the land and each other (Goldschmidt 1947:147). However, major changes occurred with the conversion of small-scale farming operations into factory farms, mobile operations, and consolidated holdings. The most common of these became factory farms – large land holdings that became corporate entities in which ownership, production, and processing all took place on site.

During the past several decades, alternative forms of modern agriculture have gained popularity stemming from the protest against conventional agricultural praxis. Alternative agriculture, developed largely in is simply a set of ecologically-based

techniques that embrace the principles of integrated soil, pest, and farm management – commonly known as the I3 of farming (Vandermeer 1995:202-203). There are many forms of alternative agriculture – including sustainable agriculture, organic agriculture, ecological farming, holistic farming, low input sustainable farming, natural farming and permaculture (Vandermeer 1995:201). While many of these forms of agriculture emerged from developed nations, it is worth noting the basis of these lie with agriculture as it was practiced in native cultures.

Converting conventional high-input agricultural methods into more sustainable methods is thought by many to pose too much negative impact on crop yield and farmer income, thus decreasing the food that is available for an already-inadequate system. However, researchers indicate there is actually ample food production on a worldwide basis (Bagdley 2007:80). The problem lies with food distribution practices (Hadley 2011). If food security is the only issue, then there should be no need to modify an entire system- just the parts that do not work well. Yet humanity is still faced with growing populations and dwindling resources, resulting in a spider web of interrelated issues and challenges.

Many texts addressing this question fell back on the idea of ecology. First used in the early 19th century, it offers a fitting schema to begin reframing questions and issues about agriculture and food systems. Ecology broadly refers to the interconnected nature of all aspects of the Earth's environment became widely used to express a view of nature – including humans – as a complex whole with an organic coherence extending beyond

physical, chemical, or biological definitions (Worster 1994:21). In the 20th century, ecology grew into a real scientific field and a new environmentalism emerged. This new science called for nature to be viewed as "a vast, intricate community, a systems of connections and interchanges highly vulnerable to disturbance, in which humans must inescapably depend" (Worster 1994: 350-352). The broad study of ecology spawned many subfields, some of which can be seen as concentrated, independent fields of study on their own – including ones like agroecology, human ecology, cultural ecology and ecology of mind.

As such, the idea of ecology unites many fields of study – including the three disciplines that I used as the basis for my course – agriculture, anthropology, and systems science. It provides a basic framework that can be used to conceptualize the complexity of a system so it includes relevant environmental and social factors. The application of an ecological framework to complex issues can be found in both the theoretical and the practical aspects of this project, for ecology provides a unifying point of entry for students who are new to the material. Interestingly, another common theme arose on assessing ecology – the notion of sustainable agriculture as an academic field in and of itself. In other words, people can use integrated systemic perspectives rooted in this field to reassess the way agriculture is currently practiced.

Ecologically Minded Agriculture

Modern agriculture is a system that works well, at least for the time being. Annual yields are high and ample calories are produced to feed both people and animals

raised for food. However, humanity is still experiencing food crises, food insecurity, petroleum dependence, pollution, loss of bio-diversity, and a host of other challenges that are the results of current agricultural policies and practices. In the United States, 17.4 million people are considered food insecure. These individuals have uncertainty and/or difficulty accessing or acquiring ample amounts of quality food to meet their food needs at some point during the year (USDA 2011). Food distribution policies and processes are of particular concern when comparing agricultural yield with the number of food insecure individuals across the globe. In addition to food insecurity, access to ample amounts of energy varies in both terms of affordability as well as quantity. Agriculture depends on petroleum for fuel to power its activities as well as for providing inputs such as synthetic fertilizers and pesticides.

Ecology is the missing science in modern agriculture (Magdoff 2007:110). By considering the characteristics of natural ecosystems – efficiency, diversity, self-sufficiency, self-regulation, and resiliency – a more sustainable form of agriculture may be achieved. Using an ecological and transdisciplinary framework built on the pillars of the Sustainable Development Model, strategies can be developed for addressing systemic challenges stemming from the interactions between agriculture and global economics, food security, energy security, climate change, and natural resources. The requisite natural resources for a vibrant agriculture in the context of modern society and our environment are limited. Thus, the literature I reviewed for a deep understanding of an integrated approach to food systems was thin. Interestingly, a common question arose in

many of the texts from agriculture, anthropology, and environmental studies – why are issues involving human-environment components not viewed or addressed as complex interrelated systems?

Module 4 | Agriculture and Global Economics

This module is the first in the course to directly address the call to action by the Farm Foundation and is intended to be presented in a one-week period. The module begins with a general discussion of global markets and recessions over the last 40 years. The resulting ebb and flow of imports, exports, and availability of credit affects agriculture as financing becomes increasingly difficult given the cost of conventional farming around the world.

Current market conditions on a global as well as a local scale significantly affect farmers' abilities to continue providing sufficient food, feed, fiber, and fuel for a growing population. Locally, farmers struggle with increased debt, price inflation, and decreased income. Globally, developing countries that are dependent on their agrarian sector have limited country credit, which makes for volatile commodity markets (Farm Foundation 2008:19-20). With depressed income for farmers, who make up the bulk of the GDP in many cases, many are not able to purchase the necessary inputs to continue farming. As the ability of farmers to produce sample amounts of food, feed, fiber, and fuel decreases, the need for these countries to reply on food and fuel aid increases.

Redeveloping global market strategies using the Sustainable Development Model's triple bottom line is a daunting, but necessary, task. From an environmental

perspective, taking into consideration the need for economic markets to stabilize worldwide and the far-reaching effects the markets have on food and food systems, several strategies may be considered. Economic incentives to convert conventional modern farms to alternative forms of agriculture using more sustainable methods would alleviate some of the pressures on the environment and the economy. Ideally, farmers would embrace operations-based changes in production that employ increasing amounts of natural energy, decreased use of inputs, and decreased use of non-renewable resources. Conversion to a more sustainable agricultural production will lead to stabilization in commodity markets as farmers are able to produce crops at a reasonable price and consumers are more able to purchase them.

Whether fluctuations come in the form of markets, currency, commodities, or credit, better risk management tools are needed. Enhanced risk management programs would allow nations, corporations, farmers, and individual to manage their finances more efficiently. As funds are better managed, increases would naturally follow. Increased access to credit would allow farmers to access the capital needed to maintain and grow their operations. Additional market stabilization efforts may come from setting price limits, or more robustly, standardizing tolerable variations in commodity prices. It is usually impossible to identify the 'best or right' price for a given commodity, but it may be possible to establish acceptable variations in price fluctuations. Finally, adoption of fair trade and fair wage programs would increase economic resources for those engaged

in agriculture and other industries that produce goods and materials traded on the global market.

Social programs related to finance markets are intertwined with the environmental as well as economic factors of the triple bottom line. Many of the previously-mentioned possibilities relate directly to building healthier communities by enhancing individual success. The effects of conversions to more sustainable methods, increased lines of credit, access to risk management programs, and fair trade and fair wage programs all contribute to increasing Purchasing Power Parity (PPP). PPP is attributed to the relative cost of goods as well as currency value. As markets, employment, and income stabilize, equilibriums occur. These equilibria are attributed to commodity affordability so access to food and materials required for success are obtainable. As PPP increases, individual portfolios grow.

In conjunction with risk management programs, public education campaigns focused on money management would produce an informed public that is more capable of understanding economics, markets, and personal finance. Using enhanced risk management tools, individuals can diversify their portfolios to increase their streams of income and thus create a more stable financial future. Combined, these factors would contribute to a decreased need for food aid and food imports, thereby contributing to the creation of more self-sufficient societies.

Module 5 | Agriculture and Food Security

This module examines material on global food security and is also presented in a one-week period. It focuses on the need for increased policies and practices that should be adopted to not only secure means for producing and distributing agricultural products, but also to ensure food safety for consumers. According to the United Nations (UN), food security refers to a wide range of challenges effecting food systems. Issues such as food deprivation, production and trade, dietary needs and diet composition, access to food, food aid, nutritional status of food, and how these relate to health, poverty, and population are all included in the UN's assessments of food security (FAOSTAT Metadata 2008). While all of these components are important, there are several key issues missing from this description. If food systems and food security were analyzed from a systems perspective, the description would be expanded to encompass resources, production, distribution, consumption, waste, and recycling (Leonard 2007).

Healthy agricultural systems are essential for healthy and secure populations, so it is important to frame food production and production security in their entirety as strategic assets for countries in specific and humanity in general. Damage to any aspect of a food production system can interrupt the ability to produce and provide food for people. Such damage can also disrupt food exports and the distribution of food aid. Food security policies and legislation should not only protect food production and distribution from internal and external threats, but also they should ensure that people have reasonable access to safe, quality food.

With a growing population, farmers must increase the available food supply while decreasing damaging effects on the environment. Using the Sustainable Development Model, strategies to accomplish this goal are possible. By adopting ecologically-based farming methods, farmers can effectively adapt to their environmental contexts and work with their surroundings instead of against them. Fertilizers and chemical outputs account for higher production costs as well as increasing toxicity of the land. By eliminating or substantially reducing these inputs, the land, water, and air as well as the produce and animal products will be cleaner. However, there are a great number of challenges when converting from conventional agriculture to more ecologically-based practices. The most pressing challenge is that of decreased yield, leading to decreased profit at the onset of the conversion effort (Gliessman 2007:289).

In modern times, the challenge of food system security and access has been the responsibility of a nation's Ministry of Agriculture. Not only were these entities responsible for food availability, security and safety, but they were also responsible for expansion programs, technology, and resource management (Brown 2006:179). Today, communities are taking many of these matters into their own hands. Community farms are emerging in rural and urban settings. Farmer's markets are gaining popularity and encouraging community members to get involved by investing in local food systems.

Module 6 | Agriculture and Energy Security

This module examines material about the complex challenges of energy needs and energy security. Presented in a one-week period, it focuses on the impending energy

crises as the systems rely almost exclusively on non-renewable sources. The lack of energy security is further exacerbated by infrastructure, access, and consumer costs.

Globally, challenges in energy security stem from many sources. Notably, energy is accessible to those who can afford it. Developing countries are counting on enhancing roads, railways, and suburban housing which accounts for increasing petroleum needs instead of decreasing petroleum needs (Brown 2006:38). As petroleum and electricity prices rise, air freight and travel, automobile, household energy providers, and food production and distribution systems will be negatively impacted. During these times consumers begin to voice a great deal of concern over supply as well as cost, although public apathy wanes during times of low energy costs.

Agricultural energy consumption is also significant. As a culture and society that has become accustomed to a wide range of food availability year round, public understanding in the United States is low in regards to the distances that food products travel so they can be available in community retail establishments. In order to ensure that out-of-season produce is available during the late winter and spring, it has to be shipped from various global origins. The energy requirements to keep these out-of-season fruits and vegetables on the market year round are shockingly high (Brown 2006:28).

Agricultural energy needs are not limited only to the fuels necessary for running field equipment, operating factories, or transporting produce. Petroleum-based inputs are also common in conventional farming. Nitrogen fertilizers, used in lieu of cover cropping, are frequently applied season after season, creating high levels of toxins in both the

soil and water run-off. Chemical applicants in the form of pesticides, herbicides, and fungicides are primarily petroleum based (Jackson 1985:23-24).

Unlike many industrial sectors, agriculture also has the unique opportunity to produce conventional fuels. The demand for biofuels is based on the increasing prices of conventional fuels. While the increase in interest for alternative fuels is a positive movement toward national and global sustainability, public interest usually wanes when conventional fuel prices stabilize (Farm Foundation 2008). The time for investment in alternative energy strategies for long-term research and development is now. Yet, crops grown for biofuels such as corn-based ethanol are substantially decreasing the available land for food and feed purposes (Tilman et al 2009:270-271).

Decreasing energy consumption and securing a more sustainable agricultural future depend on funding to conduct infrastructure research and to improve public transportation. Redesigning urban transportation systems has long been a necessity. Some cities have amazing systems, which may be emulated throughout the nation, but each are designed to fit specific populations, geographies, and budgets. Combinations of rail, road, bicycle paths, and pedestrian walkways offer increased mobility and low-cost transportation that can lead to increased personal health benefits, and healthier urban communities (Brown 2006:209). Some cities have encouraged bicycle and pedestrian means of transportation by imposing taxes on vehicles as well as road usage during high traffic times. Congestion taxes are emerging in cities around the world to decrease both

the overall number of vehicles on the road as well as the number of vehicles entering urban centers (Brown 2006:210).

The means by which communities and individuals may decrease their overall energy footprint are countless. A guaranteed way to decrease energy consumption and cost is to reevaluate local food systems. New "Buy Fresh | Buy Local" campaigns are emerging in restaurants, farmer's markets, publications, and non-profit food-based services nation-wide. Communities are becoming increasingly more aware of food origins and seasonality (CAFF 2013). Produce from local sources is often fresher and of higher quality. International produce is boxed and shipped, sometimes several days from its origins. Many times, this produce is not ripe when harvested because it is cultivated to ripen during transport. Raising awareness of food distribution and clarifying the numerous benefits of urban gardening can increase the desire to start urban gardens in countless new locations.

Module 7 | Agriculture and Climate Change

This module underscores the need to take climate change seriously and was designed to be presented in a one-week period. Recently-published data suggest that temperate climes will experience more drastic changes in temperature than tropical climes. Strikingly, temperate zones contain half of the world's population and climbing summer temperatures will soon represent the new normal. The result of these factors will include increased stress on crops and livestock resulting in the decline of annual yield (Battisti and Naylor 2009:244). Failure to address the major forcing functions, or

action drivers, that directly affect climatic changes, along with the changes in environment, may cause undue hardships due to decreases in inhabitable land, the availability of natural resources, and access to fresh water. While climate change affects the temperatures, rainfall, and amount of arable and grazing lands, the use of petroleum-based inputs, air and water pollution, topsoil loss, and shrinking biodiversity pools also threaten global agriculture (Horrigan et al 2002:446-448).

The likely result of climate change and its effects on land and agriculture will be increased market volatility, price spikes in food products, and decreased access to food by those who can no longer afford the high prices. Additionally, those displaced by severe weather – often referred to as environmental refugees – typically find themselves in temporary camps with crowded conditions, contaminated water, food shortages, and increased disease susceptibility. At the current rate of desertification in arid regions and rising sea levels in coastal regions, there is a real possibility for hundreds of millions of environmental refugees around the world (Brown 2006:116-117).

Clearly, national and international strategies regarding climate change and its effects on the planet are necessary. Many people are weary of hearing about climate change because a great deal of blame is placed on consumers who enjoy products such as sport utility vehicles, private aircraft, and heating and cooling homes. Other arguments focus on eating what one desires versus consciously choosing local, seasonal produce. Regardless of the specific argument, climate change and its effects will become increasingly distressing if ignored. Relying on integrated strategies to combat excessive

contributions to climate change, the Sustainable Development Model provides a platform to begin undertaking the challenges of converting consumption-based practices and behaviors with more sustainable ones.

Module 8 | Agriculture and the Environment

This one-week module centers on the pressure that increased population and development are placing on the planet's natural resources. As these resources decline, the propensity of conflict within and between communities arises. In addition to the stresses of mining and harvesting fossil fuels such as petroleum, natural gas, coal, our forests, fresh water sources, land, topsoil, fisheries, and plant and animal diversity are also vulnerable.

Modern agriculture successfully feeds a global population of 7 billion – but it is a vulnerable system. Agriculture relies on natural and manufactured inputs to ensure that ample products are grown to meet the full needs for a growing global population. In turn, with pressures on agricultural production due to greater demand in the face of decreasing natural resources, the ability to produce food and other agricultural products will soon be in direct competition with each another as well as with other systems requiring the use of those natural resources. Providing ample agricultural products is a critical issue in moving forward successfully. Logically, feeding a growing population decreases available resources, thereby creating critical issues in agriculture.

People have successfully navigated environmental hurdles in food, fiber, and fuel production throughout human history. During the agricultural revolution, human food

system was restructured due to climactic and environmental phenomena. Hunter-gatherer communities became increasingly sedentary as humans learned the art and science of crop cultivation and animal husbandry – agriculture. This new way of life not only triggered increasing technological discoveries and innovations, but it also led to dramatic increases in human populations and forever transformed the planet. More recently, during the last two centuries, the Industrial Revolution has seen incredible advances in technology, science, mechanization, and economics. This revolution, with its complexity and benefits to the standard of living, access to goods and services, and amenities, has been transforming both the planet and the atmosphere for more than 200 years (Brown 2006:247). Both the agricultural revolution and the Industrial Revolution drastically changed human food systems.

It is time for another change. As people become increasing impacted and better aware of the significant challenges and consequences stemming from our over-use of natural resources, an "Environmental Revolution" is mounting (Brown 2006:248). The major focus point of this revolution will be a shift to new sources of energy, as well as how those new sources are used. Energy is required for every global industry and no industry will go untouched by this revolution. Shifts in economics in terms of who and what is subsidized or taxed, changes in environmentally sustainable land and water use and protection policies, and modifications of how agriculture is practiced are also part of this revolution. Agriculture is a core requirement of a successful future for human beings

everywhere. By ensuring future resources, not only will it become increasingly secure, but it will also provide a secure future for food availability for generations to come.

Module 9 | Global Economic Development

Perhaps the most important module, this one focuses on global economic development as the key to successfully moving through future decades. A business-as-usual trajectory will lead to multiple industry collapses and irreversible environmental damage. While growth in today's economy is measured in the trillions of dollars, this translates to consumption of resources faster than they can be regenerated. Frighteningly, this pattern is not new. Earlier civilizations, such as the Sumerian or the Mayan Empire, collapsed when they were unable to adapt or adjust in time (Brown 2006:4). Optimistically, the new economy emerges with alternative fuel vehicles, solar panels, wind farms, bicycle paths, farmer's markets, changes in crop choices, and public awareness.

A sustainable global economy will most certainly be based on paying better attention to environmental factors. As Garrett Hardin noted in his famous article on the "Tragedy of the Commons" (1968), which was based on an assessment of archeological records, many previous civilizations declined due to a lack of natural recourses and an inability to feed their growing populations. As resources become increasingly scarce, resource management in the face of diminished quantities will become critical. Public awareness is not the central factor in this equation. The primary challenge is the ability of governments to discourage population growth, develop and implement sustainable policies, and restructure the global economy before the point of no return is reached.

Demands made on multiple natural systems that relate directly to the ability to produce crops, including land and water, have exceeded sustainable yields. While there have been a few national reversals of the effects of overuse and scarcity of resources, China is a prime example of a nation's ability to overcome widespread poverty and food insecurity. Between 1977 and 1986, China increased its grain harvests by 50 percent and announced in 2005 that it was no longer in need of international food aid (Brown 2006: 163). True, China relied heavily on high yield seed, irrigation, and synthetic inputs. China's healthier population with ample calories led to a stronger workforce and an exponential growth in economic output.

China is the exception rather than the rule, however. There is hope that it can serve as an example of positive changes in existing systems. The difference between China's efforts and those in the United States is due to the creation and implementation of policies using integrated and sustainable frameworks. Global economic development hinges on conservation and protection of natural resources. Research and development into renewable alternative energy, manufactured materials, and consumer-driven products and services can be accomplished in environmentally-sustainable ways.

Module 10 | Agriculture as an Integrated Strategic Asset

The final module frames agriculture as a hyper-complex system comprised of myriad independent parts – in essence, as a system of systems (Reckmeyer 2009). In order for declining numbers of farmers to provide ample amounts of food, feed, fiber, and biofuel for a growing global population, policies enacted by governments in support of

these endeavors have had detrimental effects on the environment. Harsh chemical-based inputs used to boost production have contaminated our land, water, and food. Quality products have been pushed to the wayside in favor of high yields of cheaply produced harvests. Policies, taxes, and subsidies all support conventional agriculture instead of sustainable methods with potentially smaller yields per operation, but with ideally more locally-based operations, ensuring quality and freshness, and decreasing food miles.

Instead, agricultural policies, as with most policies in the United States and around the globe, are profit driven. The bottom line, however, is that natural systems are now overused and degraded; as such they will not support the current global trajectory. Agricultural systems have been reduced to industrial systems and viewed as mini-factories, manipulated for maximum output (Gliessman 2007:3). Regulations regarding toxic inputs, run-off into waterways, carbon emissions, use of fossil fuels, and genetic engineering of plants and animals are thin. Moreover, other forms of governmental leverage like fines, taxes, and oversight do not exist – at least not enough to promote more sustainable approaches to agriculture.

Viewing agriculture as a way to leverage a healthy nation is critical. Nations, as a whole, are the greater than the sums of their parts; each part must remain intact and working well in order to positively contribute to the whole. As resources diminish, populations and communities fail, and instability sets in. Even worse results often occur in failing or failed nations where the break-down of law and order after the depletion of resources, infrastructures, and local economics results in the loss of personal security and

the spread of aggression and terrorism. Civil conflicts arise, warlords emerge, and death rates from direct violence, hunger, and disease soar (Brown 2006:118-119). The societal result of such conflict are high rates of orphans, injured and mutilated people, and wide-spread homelessness. In many situations, UN peacekeeping efforts are undertaken with the assistance of military personnel from member nations. In the cases of Afghanistan, Haiti, and Sudan, multinational forces were deployed to keep order (Brown 2006:119-120).

It cannot be ignored that there are 60 nations already on global watch lists due to vulnerabilities, depressed economies, and potential conflict. Who is responsible? Is the developed world responsible for the developing world? The ability to move these nations from failing or failed status to stronger, more sustainable circumstances are necessary, but who shoulder's the responsibility? These are questions that must be addressed as we evolve agricultural policy and strategy.

Conclusion

These ten integrated modules are the heart of the course that I developed in my project. They encompass the principal knowledge that I think students need so they can understand both the fundamental role of agriculture in human prosperity and the growing need to develop more sustainable forms of agriculture for a healthy global world. It was evident early on in the project that each one of the major systems affecting agriculture is inextricably linked to the next. This means that conditions will not improve unless the world's agricultural practitioners and policymakers stop operating in a mutually exclusive

manner and start working together to address common concerns in more coherent ways. The course provides an opportunity for multiple audiences in a wide range of settings to begin learning why it is so urgent to developing increasingly sustainable practices and policies when it comes to food, feed, fiber, and fuel.

CHAPTER 4

PROJECT REFLECTIONS

Introduction

The learning and discovery process in conducting this master's degree project has been remarkable for me, in my role as a curriculum designer as well as in my role as a graduate student. In addition to working through a complex project informed by numerous mentors, literature searches and reviews, university coursework, and endless days and nights of writing, the shear amount of data produced from the course modules was staggering. I developed a great deal of pride in this accomplishment and hope to present it on numerous stages in the near future.

Project Context

After reviewing courses offered by academic institutions related to systems science and agriculture, it became clear that very few degree programs focus on similar content from a transdisciplinary perspective. There are a handful of universities with agricultural programs that incorporate the study of other systems, but they do so in over view courses that have been designed to examine connections and relationships between agriculture and one other system (such as economics or resource management). There are not many courses or degree programs, however, that focus on a breadth of complex interconnected systems. Interestingly, there are no courses at any university that offer content based in systems science, anthropology, and agriculture like my course does.

After an extensive online search on degree programs, courses, and syllabi, I was unable to locate a single course similar to that developed for this project.

One of the few universities to boast an agricultural program rooted in systems science is the one at Texas A & M University. Its program is described as providing students with "management and systems science techniques such as linear programming, simulation, optimization, queuing theory, inventory models, PERT/CPM and expert systems are taught along with applications for solving realistic problems faced by agribusiness managers" (TAMU 2011). Students in its Agricultural Systems Management Program are exposed to a series of courses dealing with modern agricultural systems, power and energy systems, systems analysis of agriculture, agricultural systems management, and information technology for agricultural systems. In addition, students also take courses in business, economics, government, law, and environmental studies. Combined, these courses present different components in a systems perspective; but students must take multiple courses and hope each one is designed to be complementary to the next. Many times, they are faced with the complex course content being presented in a mutually exclusive fashion, where it is solely up to the student to make connections between different courses.

Other universities with outstanding agriculture programs include Iowa State University, Purdue University, Cornell University, and Washington State University. However, none of them provide substantial course offerings rooted in systems science or courses that are multidisciplinary. Most shocking were the results from researching

course offerings at CSU-Fresno, CSU-San Luis Obispo, University of California-Davis, and University of California-Merced. None of these universities, which have highly rated agricultural programs, focus on systems science or agriculture's interconnections with other major systems.

Implementation and Benefits

The relevance of such a course to an academic department is that it complements a number of currently offered required and elective courses. Its contribution to the field of anthropology is based on its ability to help students learn about important agricultural issues, rooted in a transdisciplinary framework of systems science and anthropology, so they are able to visualize real-world situations and use the classroom as a structured environment to effectively brainstorm and navigate solutions. The course is a point of departure for students to master area-specific material and develop a variety of skills that can be added to their "toolkits" – tools like cognitive skills, communication, teamwork, evaluation, and reflection. The course also enhances their general ability to conceptualize complex multidisciplinary issues using systems science and work through solution-based activities using the cybernetic model.

Now that I have completed this project, I have started exploring several next steps I can take to share this material with others. First, I would like to work with members of my committee to pilot the course in an appropriate academic setting. I think it would best to begin as an upper-division undergraduate offering, but open to graduate students who are interested in elective credit. I recognize this may be difficult, given the budgetary

constraints affecting many colleges and universities these days, but it may be possible to serve as a guest lecturer and present specific modules in existing courses. Second, I am looking forward to presenting different parts of this material as individual modules in professional settings. As a former Teaching Assistant for Dr. Reckmeyer when he was Strategic Advisor and Core Faculty Member with the California Agricultural Leadership Foundation (CALF), and as a Salzburg Global Fellow in the Global Citizenship Program at the Salzburg Global Seminar (SGS), it would be ideal to present some of this material at sessions in one of those venues (or in a venue with similar interests). Third, as a long-time member of several professional associations, I would like to present a condensed version of one or more modules at their annual meetings.

In addition to presenting this work in academic and professional settings, I am also interested in adapting the material for publication. The subject matter addressed in each module is currently at the forefront of many journals, debates, online blogs, and other forms. The content of the modules is not only multidisciplinary, but cross-relevant as well, so I am optimistic that there will be a variety of opportunities for sharing my work with a broader set of interested audiences. Finally, I intend using the results of this project as part of my applications to doctoral programs in sustainable agriculture once I have completed my graduate work at San José State.

Project Significance

Looking at the component parts of agriculture from a systems perspective allowed me to analyze its multiple dimensions, domains, intersections, interconnections, emergent

properties, stakeholders, and contextual factors. Using a blend of anthropological, agricultural, and environmental contexts as they relate to systems science enables people to systematically develop common goals and work toward relevant solutions. Mobilizing people through interactive collaboration, starting with application-based work a course like this, is vital to producing the necessary changes within a system.

From a global perspective, there are no systems that are mutually exclusive. Just as local and state agriculture are inextricably linked to national production, so too is national production linked to global production. While the ability to produce food and access to food are diverse and in some cases, stratified, all people are absolutely linked to one another in today's global context.

Global recession, unemployment, poverty and food insecurity are wake-up calls. Changing weather patterns, creating intense storms and displacing communities with environmental refugees, are just one of many wake-up calls regarding climate change. Increases in temperature and decreases in rainfall, along with disruptions of growing cycles and crop yields, are also wake-up calls. Volatile petroleum prices and civil conflict in the Middle East and northern Africa are additional wake-up calls. Because global systems have deteriorated to the extent that many systems are declining at the same time, there arises a need to prioritize global attentions on policy changes and implementations (Brown 2006:252). There is a sense of urgency among many people and a strong need for global leaders who can both visualize the complexity and the magnitude of the challenges at hand and possess the ability to conceptualize sustainable

solutions. It is no longer a question of will various natural systems collapse under current policies, but when.

The choice is ours – we can either continue on the consumer-centric and profit-driven path of convenience and disposability or we can adopt more sustainable ways of practicing, regulating, and consuming what we do. Individuals hold the key to change in behaviors, conscious spending, and educating others. Changes have occurred so rapidly that many have difficulty understanding the severity of the situation at hand. While agriculture is a primary requirement of a healthy society and a sustainable world, the systems that support agriculture must be addressed first. If land, water, or soil systems fail, agriculture will fail. If communities no longer have access to food through some combination of reliable local and global farming, humanity will collapse. Clearly, we need to make changes in polices, practices, and individual behaviors so humanity as a whole can collectively build a more sustainable world.

Lessons Learned

I learned a lot professionally and personally as a result of my participation in this degree program and especially through my work on this project. That's why the program requires a culminating project or thesis, of course, for they are intended to help students pull together what they have learned in their graduate course work. The results cannot be fully measured, but the highlights are clear. While I have been successful in applying this knowledge in various professional environments, the lessons learned about myself, my personality, and my perseverance in finishing this project have been most valuable. I

experienced many ups and downs during my academic program and believe that I have successfully navigated real-life challenges on the road to earning my master's degree in applied anthropology.

Professionally, I had the opportunity to hone my skills during graduate school as both a teaching assistant and an employee of several agriculturally-based non-profit organizations. One of the most valuable experiences was the interactions with mid-career professionals who worked and resided in predominantly conservative areas. Given my focus on education for more sustainable agriculture, many times I found myself engaging people who held opposing viewpoints and doing so without judging them. This was extremely difficult in many cases, but it was an opportunity for me to learn from others as well as to learn how I can better convey my ideas to a conservative audience.

During the weeklong student session at the Salzburg Global Seminar in Salzburg, Austria, I was able to use my experiences to broaden my understanding of global issues and to develop my leadership skills. That experience also reinforced my knowledge of systems science, cybernetics, and globalization as they relate to agriculture and the need to change how polices are made using higher education as the vehicle. I found that moving out of our comfort zones and into a hyper-complex learning environment was life-changing for me and many students in Salzburg. This was a key element in reinforcing my desire to create curricula for more globally-minded and goal-driven students.

In Santa Clara County, as a contributor to the startup operations Full Circle Farm in Sunnyvale and Veggielution Community Farm in San Jose, I was tasked with helping frame the business model of the organizations as well as lay the foundation for the education department. Having a few years of farm-based teaching experience, I developed courses for a wide range of audiences. The educational model we used was similar to that of this project, in that weekly instruction was designed to build on previous weeks and prior knowledge. Additionally, as students graduated into the next grade, their time and responsibilities in and around the garden increased. This model is still at work today as the organization grows and continues providing excellent complementary education to students while also strengthening their relationship with the Santa Clara Independent School District.

My contributions to these organizations came ended when my husband and I moved with our infant son to Austin, Texas. Now settled there and sorting out next steps, I am looking forward to identifying local farming projects where I may contribute my skills as a farm and garden-based educator; I am also planning to identify organizations focused on agricultural policy. Austin has a blossoming farm and garden movement, even though statewide agriculture is overwhelmingly conservative. I am interested in using my skills in leadership, systems science, agriculture, and anthropology to help promote a growing movement of a sustainable agriculture for the next 30 years and beyond.

Hope for the Future

The primary focus of my project was to deepen the understanding of agriculture as a complex system and its strategic role in human success through the creation of a university-level elective course. Central to the project was an emphasis on student development. By identifying techniques to better understand the relationships and major crossroads between agriculture and related issues in food, feed, fiber, and fuel production, students emerge better prepared to join teams of applied professionals who are working toward solutions to real world problems. While the generally-understood purpose in higher education is to build human capital, at times it is more important to build social capital. Educating people about agriculture as a system and its interrelated issues is not fundamentally about providing knowledge to be applied toward future employment. Rather, it is about cultivating knowledge and meaningful investment in a sustainable and globalized future.

APPENDIX A

COURSE SYLLABUS

San José State University

Department of Anthropology

Instructor	**Class Call Number**	*Office Hours*
Sarah Linn Gallardo	***Globalization and Agriculture***	TBD
650-575-1089	Day/Time	by appointment
linn.sarah@gmail.com	Classroom	

Course Websites

http://www.sjsu.edu/people/

Course Description

This is an applied seminar for students interested in learning about agriculture, issues that affect agriculture, and how to help build a more sustainable world. We will examine the increasingly complex nature of agriculture, with particular attention to its strategic components, relations to other key issues, and the mix of environmental, economic, and social factors that are challenging the future of human progress. We will also examine the adverse consequences that are likely to occur if these challenges are not appropriately addressed, the use of a systems approach for addressing challenges in more integrated ways, and the paramount need for better collaboration among diverse sets of critical stakeholders around the world. Our focus throughout the course will be on exploring the characteristics of a more sustainable agriculture, with an emphasis on systems thinking, the Sustainable Development Model, and ecology as fundamental core competencies.

Course Learning Outcomes

This course is intended to assist students in developing a coherent framework for examining the interaction of complex issues and working with others to make the world a better place. Key learning outcomes reflect these general goals. Upon successful completion of the course, students will be able to demonstrate:

- an understanding of the nature and practice of agriculture in a complex world
- a broad sense of agriculture as an interconnected whole, including the impact of major key issues that affect it such as economics, security, and energy, and natural resources
- an idea of need to view agriculture as a strategic issue as it directly impacts human society and the planet's natural environment
- an advanced competency in the upper-division intellectual and practical skills needed for strategic analysis, critical thinking, written and oral communication, information literacy, interdisciplinary teamwork, and systemic problem-solving
- an ability to apply the knowledge, skills, and responsibilities learned in this course to work with diverse sets of stakeholders on complicated issues in new settings

Our overarching goal is to increase participants' aptitudes for becoming more effective change agents.

Course Learning Activities

This is an upper-division elective seminar, in which students are expected to help each other individually and collectively accomplish these learning objectives through an integrated systemic teaching-learning framework. Together we will learn about agriculture and its integrated parts and relationships through a combination of teaching, research, and practice that includes the following teaching-learning activities:

- formation of small learning teams to lead class discussions and conduct team projects
- weekly resource assignments and interactive student-led discussions of resources
- targeted presentations on key topics by the course instructor and invited guests
- weekly comments by the teams on key learning questions/points
- variety of other classroom activities (videos, simulations, presentations, etc)
- team projects that investigate specific relations between agriculture and issues that affect it, analyze the most important strategic issues stemming from that relationship, and develop strategic action plans for improving those challenges in an integrated fashion

- individual synthesis papers that reflect on the lessons learned from our semester's work together and development of a plan to enhance personal and social responsibility

We will spend the first few weeks of the semester collaboratively designing the course as a whole, finalizing the course schedule, and completing personal learning contracts.

Course Learning Assessment

Students will demonstrate their relative mastery of course learning objectives through their performance on the following assignments (as specified in their learning contracts):

- autobiograpghy paper (10%-20%)
- team project, including the delivery of one formal 30-minute class PowerPoint presentation (20%-40%)
- individual synthesis paper (final) (20%-40%)
- regular and responsible participation in completing the readings, engaging in class discussions, contributing to weekly emails, and conducting team projects (5%-15%)

There are guidelines for all course assignments, available in electronic form on the course website. These include detailed rubrics and templates for completing the assignments and specify the criteria for grading those assignments so we can evaluate student learning on a clear and consistent basis.

Course Resources

Brundtland Report

1987 Report of the World Commission on Environment and Development: Our Common Future Transmitted to the General Assembly as an Annex to Document A/42/427 - Development and International Co-operation: Environment. Accessible as an Electronic Document at http://www.un-documents.net/wced-ocf.htm

Farm Foundation

2008 The 30-Year Challenge: Agriculture's Strategic Role in Feeding and Fueling a Growing World. Accessible as an Electronic PDF Document at http://www.farmfoundation.org/news/articlefiles/1694Final%2030%20Year%20Challenge.pdf

Course Reader

2011 Globalization and Agriculture: Ensuring a Sustainable Future. Available at Maple Press, 481 East San Carlos, 408-297-1000

Course Schedule and Topics

Dates	Content Topics	Learning Topics
Class 1	Humans and Agriculture	Systemic Learning
Class 2	Systemic Course Design	Learning Contracts
Class 3	Agriculture as a System	Decide Project Teams
Class 4	Current State of Agriculture	
Class 5	The Big Debate	
Class 6	A Better Agriculture	
Class 7	Global Financial Markets and Recession	
Class 8	Global Food Security	
Spring Break	☺ Holiday ☺	☺ Holiday ☺
Class 9	Global Energy Security	
Class 10	Climate Change	
Class 11	Competition for Natural Resources	
Class 12	Global Economic Development	
Class 13	Agriculture as a Strategic Asset	
Class 14	Project Teams 1 & 2	Presentations
Class 15	Project Teams 3 & 4	Presentations
Class 16	Final Examination Period	Reflective Syntheses

Course Grading Policies

An integrated set of course materials are available in electronic form on the course website, including detailed guidelines for all assignments that include specific grading criteria for each assignment. Students should familiarize themselves with these materials and use them to proactively prepare for class sessions and assignments on a timely basis. Assignments will be penalized 10% each week they are late, unless there are extenuating circumstances. When preparing these assignments, it is important to remember that people who live and work in a globalizing world must be able to communicate successfully with a broad variety of audiences. SJSU graduates are expected to write well and deliver effective presentations, which usually require several iterations to refine before work it is sufficiently polished to be shared with others. Students should pay close attention to the guidelines and templates for each assignment, particularly in terms of ensuring that they are submitted in the appropriate format for that assignment. It is also helpful to seek feedback and suggestions from others (including members of the learning teams) to help finalize your work. In addition, the Uni-versity offers assistance for students through group workshops and individual consultations at the SJSU Writing Center in Clark 126 (http://www.sjsu.edu/writingcenter/ or 924-2308).

SJSU Academic Integrity Policy

SJSU expects all students enrolled in the University, whether on a matriculated or extended education basis, to act in accordance with accepted academic and professional standards for integrity at all times. Official University policy states that:

> Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Judicial Affairs. The policy on academic integrity can be found online (http://www.sjsu.edu/senate/S07-2.htm).

The most common issues of academic integrity are usually associated with some form of plagiarism, which is using other people's ideas and words without clearly acknowledging the source of that information. Sometimes it is tempting to copy other people's ideas (from the Internet, textbooks, magazines, lectures, or student papers) and incorporate them into your own work. As a result, it is very important to give proper credit to those sources. If proper credit is not given, then you are passing these ideas and words off as your own. This is both unethical and illegal. Students who engage in any form of academic dishonesty that contravenes SJSU policy will result in a failing grade (F) on that assignment for all parties involved and may lead to dismissal from the course and possibly the University.

SJSU Disability Policy

SJSU also recognizes that some students may require special accommodations to participate in a particular course. If any student in this course needs such assistance and/or would like to share emergency medical information, especially as it might affect potential safety issues like evacuation procedures, please contact me privately as soon as possible so we can decide how to proceed. Presidential Directive 97-03 requires that students with disabilities register at the Disability Resource Center in Admin 110 (http://www.drc.sjsu.edu/ or 924-6000) to establish a record of their disability so they can utilize the University's resources.

APPENDIX B

Title

A Food Autobiography

Presented to

Dr. William J. Reckmeyer

In Partial Fulfillment

of the Requirements for

CLASS ID

by

Student's Name

Date

Introduction

This mini-section should be a paragraph introducing readers to the topic and scope of your paper, briefly laying out the central themes it is addressing in one or two paragraphs.

Personal Food Experience

This should be a major section of your paper. Relevant sources should be cited using proper scholarly format as specified by the *AAA Style Guide* and included in your bibliography – such as a book, citing specific pages when possible (Jantsch 1980: 263-274) or a journal article, citing specific pages when possible (Boulding 1956: 2001-203). Examples of proper citation for other types of sources are included in other sections of these guidelines.

Lessons Learned about Your Experience

This should be a major section of your paper. Relevant sources should be cited using proper scholarly format as specified by the *AAA Style Guide* and included in your bibliography – such as an internet source (CIA 2007) or an interview (von Foerster 1991).

Personal View of Your Experience

This should be a major section of your paper. Relevant sources should be cited using proper scholarly format as specified by the *AAA Style Guide* and included in your bibliography – such as a newspaper article (Demick 1998) or an edited collection of articles (Reckmeyer 1994).

Conclusion

This mini-section should be a paragraph pulling all the key points you have made in your paper, with an emphasis on tying together the central themes and findings from your discussion and their implications for your audience.

Bibliography

Boulding, Kenneth E.
1956 General Systems Theory – The Skeleton of Science. *Management Science* 2: 197-208. Journal Article

Central Intelligence Agency
2007 *World Factbook*. Electronic document, accessed on January 17 2007. http://www.cia.gov/cia/publications/pubs.html. Internet Document

Demick, Barbara.
1998 Dissent Greets Pact's Signers. *San Jose Mercury News*, October 26. Newspaper Article

Jantsch, Erich.
1980 *The Self-Organizing Universe: Scientific and Human Implications of the Emerging Paradigm of Evolution*. New York: Pergamon. Book

Reckmeyer, William J., ed.
1995 *Leadership Readings*. Palo Alto: American Leadership Forum. Edited Book

von Foerster, Heinz.
1991 Interview by author, September 25. Interview

General Guidelines for the Food Story Autobiography. This should be a paper (4-5 pages) that addresses your own background with Food and Food Systems. It should include three major sections. The first section should describe a specific example of a food story (either positive or negative) that you have personally experienced at school, at work, or in another setting (such as traveling or visiting others). The second section should clarify any lessons you learned from that experience, in terms of its impact on your own views of food and food systems. The third section should summarize your

broader views about agriculture and food in general, in terms of a basic definition and those features that you find most significant.

Guidelines for Citations and Bibliography. Sources of points made in the paper must be properly cited in the text, including but not limited to data and quotations. Your bibliography must include all sources that are cited in the text, but typically includes others that were used in preparing the paper even if they are not cited. Both citations and bibliographic entries must be properly formatted to reflect editorial standards in the field of anthropology, as summarized in the *AAA Style Guide,* detailed in the *Chicago Manual of Style*, and illustrated in this template. Note that sources are formatted differently in the bibliography, depending on the nature of the source (such as the distinctions between a book and a journal article). In addition, be sure to remember that all bibliographic entries are alphabetically sorted by last name of the first author; further sorted by year if you include more than one source by the same author, and then alphabetically within each year if you include two or more sources by the same author from the same year (listed/cited as 2007a, 2007b, etc).

General Writing Guidelines for the Paper. There are several formatting standards that people are often unaware of and/or ignore when preparing academic papers. Some basic ones that commonly occur include the following:

- Paragraphs can be either ragged or justified on the right side, whichever you prefer, but be consistent throughout your paper.
- There should always be two spaces following the end of a sentence, no matter what the punctuation, rather than a standard single space.
- Paragraphs should flow automatically from the bottom of one page to the top of the next page, with no widows or orphans (single lines of text at beginning or end of the paragraph).
- Quotations that are 3 lines or less should be included in the text and cited with reference to the specific pages.
- Quotations that are more than 4 lines should be indented 3 spaces and single-spaced, followed by the appropriate citation.
- In addition to presenting your own ideas and citing the contributions of others in text format, you may also want to include data that is presented in a more organized way to make it more comprehensible for readers. One common example is the summary of data in tabular form, which should be referenced in the text (Table 1), then presented in its entirety following the end of the paragraph, centered using proper scholarly format as specified by the *AAA Style Guide*.

World's Largest Economies
Purchasing Power Parity
(2007)

Country (Top Ten)	GDP in USD (Billion $)
United States	13,860
China	7,043
Japan	4, 417
India	2,965
Germany	2,833
United Kingdom	2,147
Russia	2,076
France	2,067
Brazil	1,838
Italy	1,800

Table 1

- You may also want to present data in graphic or photographic format as well. The information should be linked in the text (Figure 1), presented in its entirety following the end of the paragraph or at the top of the next page when there's not enough space (as in this example), centered using proper scholarly format as specified by the AAA Style Guide, and included in your bibliography – just as you do with a table.
- Note the differences between the data in these two examples – Table 1 presents the top ten countries in terms of total GDP, reflecting Purchasing Power Parity (PPP); while Figure 1 portrays the top ten countries in terms of total GDP on an absolute basis. These distinctions highlight the importance of selecting and presenting your information in ways that make your points as clearly and as honestly as possible.

World's Largest Economies
Total GDP
(2007)

Figure 1

Note About the Paper in General. Papers must be submitted in proper academic format for the field of anthropology as summarized in the *AAA Style Guide* and as exemplified in this template. Major elements include the title page, margins (1" on all sides), font size (12 point), and page numbers (centered, bottom, inside the 1" margin). You are strongly advised to use an electronic version of this template to prepare your own paper (although it is not required), since it is already properly formatted (including section headings). ***If you do so, delete the sample/explanatory text that is highlighted in yellow and enter your own text***. Be aware that the default settings in Microsoft Word and other writing programs are often different than the requirements for this academic paper and sometimes distort some formatting items (such as justified margins and spacing between sections), so you'll need to make sure your paper conforms to the editorial standards that are exemplified in this template.

APPENDIX C

San Jose State University
Department of Anthropology

GLOBALIZATION AND AGRICULTURE:
ENSURING A SUSTINABLE FUTURE

Semester Team Project Guidelines

Project Description
As global citizens, by virtue of our shared roles as human beings living on Planet Earth, we have both the right and the responsibility to help make the world a better place. Effective global community and leadership involve more than demonstrating concern about the common challenges facing people in different parts of the world; it reflects the willingness to act and the ability to improve conditions. Human ingenuity generated enormous progress since the origins of our species, especially during the past 600+ years when the rise of a scientifically-based industrial western society led to the emergence of our increasingly global world. Prosperity has not been evenly distributed, however, and that progress has also created major dilemmas as we enter the 21st century.

One of the most insidious and prevalent dilemmas is the tragedy of the commons, in which the pursuit of narrow self-interest produces adverse unintended consequences for the greater whole. We live in a deeply interconnected world, one that is growing more interdependent as it becomes more globalized, and we can no longer live our lives without considering the broader collective consequences of our individual activities. Everything we do affects the world around us – environmentally, economically, and socially. Gone are the days when humanity could act with impunity, using the planet as both an unlimited fountain of resources and an unlimited garbage dump. We are beginning to realize that we have to treat the planet and each other better than we have been doing, or else face the likelihood of severe setbacks that threaten to compromise progress for everyone.

The intent of this assignment is to help us develop a better appreciation of critical issues in a globalized world facing agriculture and its related systems. Ideally, we can start to develop systemic strategies for improving the key issues at hand, through comparing the situations in several different regions of the world. It is vital to focus on regional concerns, rather than national concerns in specific (because they are too narrow and familiar) and global concerns as a whole (because they are too immense and complicated). The most pressing challenges transcend national boundaries and, as a result, cannot be resolved without collaboration across national boundaries. People are generally familiar with their own countries, too, as citizens/residents of our respective

nation-states, so we also think it is vital for all of us to work outside of our comfort zones and learn about the realities facing other people who share the planet but live in very different circumstances.

The class will organize itself into project teams, each one choosing a different region of the world to address throughout the semester in terms of agriculture and systems that directly affect agriculture in that region. The teams will engage in three major activities:

-First, during Phase 1, they will develop a basic understanding of the region and its major characteristics with a focus on its agriculture.
-Second, during Phase 2, they will identify the 3-5 most important strategic challenges facing the region's food security and clarify the interconnections between them.
-Third, during Phase 3, they will create an integrated strategic action plan to address the issues affecting agriculture so that the solutions benefit the region as a whole and not one challenge at the expense of the other. The teams will make formal presentations on the results of their work at end of each phase, following which the class will discuss the combined lessons learned from all of the presentations in order to develop a systemic appreciation of what can be done to improve conditions in these regions without compromising the world as a whole.

Project Directions

Project Preparation – Team Organization
1. Identify a geographical region of the world that you wish to investigate in this project, including why you are interested in addressing it, and come to class prepared to share your choice with other class members.

2. Each region must include at least three countries, but not so many as to be unwieldy and preferably not an entire continent (North America is off limits). In addition, no team can select the same region (combination of countries) as another team – although different teams can include some (but not too many) of the same countries in their respective regions, depending on how they are defined.

3. When instructed, find other students who seem to share your interests and collaboratively form a team to address a specific region. Wait until the professor has approved all of the selected regions before finalizing your project team.

4. The people in this team will be your learning partners in the class for the rest of the semester. Introduce yourselves to each other, exchange contact information, and discuss how you plan to work together to successfully complete your project. Be sure to select a team liaison to coordinate project communications.

5. Consider your region in global perspective and clarify what interests the team as a whole in your selected region. Reflect on the perspectives you bring to the project and how you want to use them during your work together.

6. Send the class TA, an email with basic details about your team's region (name and countries), the team liaison, and your team's complete set of contact information.

Phase 1 – Regional Analysis
1. Conduct research to develop a basic analysis of your region, addressing the following topical areas:

A. **Define your region** (including its location in the world), specify which countries are included, and summarize why your team has chosen to focus on agriculture in this region of the world at this time.

B. **Country Summaries**. Describe the basic characteristics and current conditions for each country in your region, in terms of four key factors:

- **Geographic**. Key points should include current location and size of the country, major topographical features, climate patterns, etc; relevant historical dimensions, if any; how these points influence the country's agriculture; and how the country compares with the world at large.
- **Demographic**. Key points should include total population, number and/or percentage of major cultural groups (based on ethnic, linguistic, religious, economic, social class, education, residence, etc features), distribution around the country, other distinctions that illustrate the relative heterogeneity of the country; relevant historical dimensions, if any; how these points influence the country and its agricultural production; and how the country compares with the world at large based on this factor.
- **Political**. Key points should include the general nature of the government (such as democratic, socialist, communist, dictatorship, monarchy, etc), government structure and operations, etc; relevant historical dimensions, if any; how these points influence the country's agriculture; and how the country compares with the world at large based on this factor.
- **Economic**. Key points should include the general nature of the economy (such as wealthy, moderate, poor), total/per capita GDP (Purchasing Power Parity), basic economic structure, leading sectors of economy, important economic trends, etc; relevant historical dimensions, if any; how these points influence the country's agriculture; and how the country compares with the world at large based on this factor.

C. **Regional Summary**. Describe the current situation characterizing your region as a whole, including its general relationships with the world at large.

2. Prepare and deliver a brief 15-minute team presentation to the class summarizing the results of your regional analysis, addressing the topical areas noted above, and including a polished set of PowerPoint materials using the template for this assignment. *Note that every team member must participate in at least one of the three presentations.*

Phase 2 – Strategic Challenges

1. Conduct research to identify the most pressing strategic challenges facing agriculture in your region, addressing the following topical areas:

- **Strategic Priorities**. Select the 3-5 most significant challenges, those that are important to the area as a whole (rather than particular countries), and summarize why they should be treated as strategic priorities.
- **Strategic Challenges**. Analyze the major characteristics and likely strategic impact for each strategic priority in your region, including the threats they pose.
- **Strategic Summary**. Describe the net effect of these 3-5 strategic priorities as a group, including the systemic interconnections that shape their interactions, and their collective implications for the region as a whole and the world at large.

2. Prepare and deliver a brief 15-minute team presentation to the class summarizing the results of your strategic analysis, addressing the topical areas noted above, and including a polished set of PowerPoint materials using the template for this assignment. *Note that every team member must participate in at least one of the three presentations.*

Phase 3 – Regional Strategy

1. Conduct research to develop a coherent regional strategy to improve conditions in your region as a whole, addressing the following topical areas:

- **Strategic Recommendations**. Develop an integrated set of strategic actions to resolve the 3-5 strategic priorities to enhance the regions agriculture.
- **Strategic Goals**. Summarize the intended outcomes for each of your recommended strategic actions and regional strategy as an integrated plan
- **Strategic Timeline**. Describe how your regional strategy should unfold, including a recommended timeline (with major phases) and a story for change.
- **Strategic Monitoring**. Indicate how your regional strategy should be tracked, evaluated, and modified to achieve your strategic goals under evolving conditions.
- **Regional Strategy Summary**. Describe the net systemic effects of implementing your regional strategy as an integrated effort rather than a fragmented collection of actions, of the expected consequences (benefits/costs)

2. Prepare and deliver a brief 15-minute team presentation to the class summarizing the results of your regional strategy, addressing the topical areas noted above, and including a polished set of PowerPoint materials using the template for this assignment. *Note that every team member must participate in at least one of the three presentations.*

APPENDIX D

Garden: Compost and the FBI!

Teachers: 3 FCF teachers; 45 minutes

Grade Level: 7th Grade

Materials Needed (per group):
See "compost bags" pg. 200 of "The Growing Classroom" for further reference
1 large plastic garbage bag with closing tie 1 gallon wet soil 3 grapes 2 nails
5 pieces of plastic cup 1 handful grass clippings 3 leaves of lettuce
1 slice of white bread 1 slice of whole wheat bread
3 squares of wet toilet paper

Objectives & Key Concepts:
Introduce composting as a way of managing the nutrient cycle. Discuss the importance of soil quality and compost.
Discuss the functions of the FBI (fungi, bacteria, invertebrates) in composting- compost is another form of recycling.
Fruit and vegetable scraps, eggshells, coffee grounds, garden waste, leaves and grass clippings can all be composted. To keep a healthy compost pile, you need a ratio of 'green' to 'brown' matter.

Introduction:
When the students arrive, a FCF teacher will greet them at the entrance of the garden. FCF teachers will elicit the student's knowledge about compost, explaining its purpose and benefits: it is great fertilizer for plants including fruits and vegetables; it is used in the garden plots to improve soil quality. In groups, students will create compost bags and think about what is and isn't compostable.

Instructions for Activity and/or Garden Centers:

Activity 1: All students will learn about composting and the functions of the FBI. What they are, what they do and why so necessary for the plants?

Activity 2: Students will break into three groups. FCF teachers will simultaneously instruct groups of students in making compost bags. Journaling as related to the lesson.

Closure & Follow-up Activities (for Class, Home, etc):
The students may need to do their journal in class after they leave describing what they learned about making compost and the composting experience in general.

I. Title: Exploring Food and Culture

II. Environmental Theme: Organic, Sustainable Agriculture in Urban Settings
Connecting Land, Culture, Communities, and Individuals

III. Grade Level: 8th Grade

IV. Location: A school garden or farm setting (Full Circle Farm)

V. California State Standard Curriculum Goals:
(taken from the California State Board of Education for 8th and 9th grades)

History and Social Science

A. Chronological and Spatial Thinking:

1. Students use a variety of maps and documents to identify physical and cultural features of neighborhoods, cities, states, and countries and to explain the historical migration of people, expansion and disintegration of empires, and the growth of economic systems.
2. Students relate current events to the physical and human characteristics of places and regions.

B. Research, Evidence, and Point of View

1. Students frame questions that can be answered by historical study and research.
2. Students assess the credibility of primary and secondary sources and draw sound conclusions from them.

C. Historical Interpretation

1. Students explain the central issues and problems from the past, placing people and events in a matrix of time and place.
2. Students explain the sources of historical continuity and how the combination of ideas and events explains the emergence of new patterns.
3. Students show the connections, causal and otherwise, between particular historical events and larger social, economic, and political trends and developments.
4. Students analyze human modifications of landscapes and examine the resulting environmental policy issues.

VI. Objectives:

* Understand subsistence patterns and native foods in home countries.

* Explore different cultures' food habits to gain insights into how culture is reflected through food.

* Interview fellow students/community members to gain further insights into food patterns.

* Identify the foods (fruits, vegetables, herbs, and spices) in ethnic dishes as they occur in the garden.

* Allow for unsupervised time exploring a garden or farm setting.

* Develop interviewing and other verbal communication skills.

VII. Materials Needed:

* Portable white board or presentation paper to write student responses on.

* White board or regular markers.

* Laminated world map (preferably with foam board on the back as support).

* Students must have pen and paper.

VIII. Activities:

1) Introduce students to interviewing each other regarding typical food habits (5 mins).

Interviewing is a key component to understanding our family, friends, and neighbors, in essence our communities. Interviewing is also a critical skill for young people to develop for confident, successful interactions in the future.

Provide the class questions that will answer what families eat for dinner (to make it simple, we will use one meal), food origins, history and folklore of foods, and ingredients. Be sure to include more open-ended questions than closed-ended questions. Little information will be learned from questions that solicit a 'yes' or 'no' answer. (It is more powerful to allow the students to devise the questions. For a multi-day lesson, that would be appropriate, but in 45-50 minutes time, provide a worksheet with the questions for the students to use.)

Sample Questions:

1) Where is your family originally from (regardless of generation)?

2) What is your favorite dish that can be associated with your culture?

3) What are the ingredients of that dish?

4) What is the history or folklore associated with that dish?

5) Did your family have a garden in their home country? Do you have a garden now?

2) Organize students into small groups (no more than 3) and ask them to interview each other using the interview schedule provided/they created (10 mins).

Allow students to pick a spot of their choice in the farm or garden to explore each others' food habits. This gives them a sense of decision and choice as to where to carry out their assignment. Picking their own spot to chat will also allow them to explore the farm or garden without micro supervision. Have the students write the answers to the questions for later collection and analysis. This will help organize later activities. While the students are working with each other, walk around to each group to assist where needed. In some cases, students may feel they have to answer in a particular way and you must reinforce that this is not the case, everyone is unique and any foods eaten are perfectly wonderful answers. Wandering among the groups will also ensure the groups stay on task.

3) Have each group report back one of the cultural stories and the types of foods eaten at home (10 mins).

Ask each group to come back to the 'circle' and report back their findings. Request that each group give a brief synopsis of one of the stories discovered during the interviews. Write the dishes, their origins, and ingredients on the portable board.

4) Once each of the groups have spoken, ask each group to tour the garden and make a list of the ingredients in garden that are also the dish they recorded (20 mins).

Each group will explore the garden to try to identify the ingredients listed on their interview sheets in the dish their classmates shared. Ask them to find not only the fruits and vegetables, but also the herbs and spices.

This garden exploration may be the first students have had. Allow them uninterrupted time to walk through and touch, smell, and listen to develop an emotional relationship with the farm or garden. This exercise is not only exploratory in food plant identification, but also to cultivate a reconnection between the students and where their food comes from. After 20 minutes or so, ask the students to come back and regroup.

5) Have the students report their findings around the garden (remaining time).

Ask the groups to reconvene and discuss what they found. Were they surprised by anything? Were there fruits, vegetables, herbs, or spices they could not find? Did they find everything on their lists? Was it easy or difficult to identify unprocessed, 'on the vine' ingredients? Once the discussion is completed, ask the students to turn in each of their worksheets.

IX. Follow Up and Assessment:

Immediate Follow Up:

1) Take a look at the students' worksheets to see how in-depth the interviews were and what kind of food plants they were able to identify during their explorations.
2) In the next class, ask the students to follow up by interviewing family or friends with the same interview questions and turn in the worksheets.
3) For extra-credit, ask students to keep a food diary for once week detailing what they eat for dinner and the ingredients and turn in the diary on Monday in class.

Long Range Follow Up:

4) Follow up lesson plans include exploring food plant origins, seasonal foods, and environmental aspects of having gardens or urban farms accessible to the community.
5) Possible field trips: local Harvest Festivals or ethnic markets
6) Create a class cook book using further interviews of family and friends to find out how certain dishes are created.

X. Measurements:

Student Knowledge (qualitative):

1) Interview data gained through multiple interviews increases, decreases or stays constant in complexity?
2) Do students appear to have increased cultural knowledge?

Interview Data Provides the Educator (qualitative and quantitative):

1) A baseline for students' nutrition and familial eating habits.
2) Frequency of home gardens among students in the school.
3) Basic agricultural knowledge among the students.

NAME:_____

Exploring Food and Culture:
A classroom exercise in food discovery

I. Introduction

Form groups of 4-5 and discuss your family background and food habits. Please answer the following questions to the best of your knowledge. Remember- there are no wrong answers here!!!

1) What is your family's ethnic heritage?

2) Did your family have a garden in their home country? Do you have a garden now?

3) What are favorite fruits and vegetables?

4) How willing are you to try new fruits and vegetables?

II. What the heck is that??!!

Once the above questions are answered, please have ONE member of your group come to the front table and pick a plate. Take the plate back to the group and explore what the contents are. Note: these specimens are EDIBLE. Be curious and courageous- Try It!! You Might Like It!!

1) Describe/draw the contents of the plate; look, smell, feel, TASTE:

2) What do you think… a Fruit? A Vegetable? A Tuber? Why?

3) Where in the world, literally, do you think this food comes from?

4) Have any idea what its name might be?

5) What kind of recipes do you think use this food?

6) Would you buy this food on your own and introduce it to your family? Why or why not.

III. So, were you right?

My group's plate contained: _____

It is a _____

And comes from:_____

Garden: Three Sisters and Summer Transplants

Teachers: 3 FCF Teachers; 45 minutes

Grade Level: 6th grade

Materials Needed:

Corn, beans, and squash seeds	Watering Jugs	Trowels?
Peppers, eggplant, and tomato seedlings		Bucket of Compost

Objectives & Key Concepts:
Students will have an opportunity to transplant summer veggies into their garden plots, in preparation for a change in seasons.
Students will have an opportunity to direct sow the 3 Sisters in garden plots. Here they will see spacing, companion planting, and bio-intensive methods at work.
Students will see how companion pants complement each other to create complete nutrition for people.

Introduction:
As a follow-up to the last lesson, students will companion plant corn, beans, and squash in their group plots. Students will also maintain their plots and do supplemental sowing of peppers and eggplant. Students will journal about last week's protein lesson.

Instructions for Activity and/or Garden Centers:

Summer Transplanting: General maintenance of plots, and transplant summer crop seedlings into group plots.

3 Sisters Direct Sow: Direct sow of the Three Sisters into a dedicated plot.

Journaling: Students journal about last week's protein lesson. What was surprising about the difference between animal and vegetable protein? What was unexpected? What do you like to eat that is a complete protein? Based on what you ate this week, would you get enough protein if you ate less meat? What is one example of the three sisters? Why are we planting the three sisters today?

APPENDIX E

Gardening with Preschoolers
Ages 3-5 with parents or caregivers

6 class series, Thursdays
September-November
84 day cycle

Veggie Options:
Radishes- direct sow
Peas- direct sow and peat pots
Broccoli- peat pots
Lettuces- peat pots

Class 1: Introduction, Preparing the Soil, Planting

Materials: Bucket of compost, small worm bin, seeds, ample supply of sticks from the mulch, Mr. Mister or animal watering cans, small kid tools, aprons, hot water for tea, cups, pocket knife, bird netting, stakes (3-4), rocks over by blue shed

Location: Garden in general, compost bins, our plot

Introduction to the each other, to the garden, to our plot, and to the class (handouts?)

Thank you for joining us at Hidden Villa for this new gardening class. Do any of you have gardens at home? What do you grow? What are your favorite fruits and veggies? What are the different parts of a garden?

Soil
Water
Plants
What else? (sun, bees, birds, lizards, hot and cold, light and dark)

What do we start with? SOIL!

Move over to the compost bins. Introduce the kids to the compost piles; explain that we can recycle food scrapes and paper towels to make yummy soil for plants.

Talk about the FBI (fungus, bacteria and invertebrates) in simple terms. Have the kids feel how hot the compost is in the center. Use the thermometer to take its temperature.

Moving along, show the kids the cooking compost and the finished stuff. See questions below.

Introduction to worms. Have one of the worm bins, or make a small one for the purpose of this class, available for this portion. Worms are wonderful creatures who help us break down food and yard trash. They are very important and help us make food scrapes into soil. Their poop is very good for plants to grow strong and healthy. See questions below

A. A Visit to the Manure Pile/Compost in the Garden
    1. What do you see in the compost? Manure? Orange peels? Rocks? Sticks? FBI- Fungus Bacteria Invertebrates.
    2. What temperature do you think it is? FBI is working so hard.
    3. What does it smell like? Does it smell like manure?
    4. Can you find the worms? What does worm compost feel like?
    5. Munch Munch Munch, Wiggle Wiggle Wiggle, Poop Poop Poop
    6. Why is the compost so important for the plants we grow here? It provides plants with really good food so they grow big and strong. What else do plants need to grow big and strong? Sun, Water, Soil

Once we are done at the compost piles, we can move over to the garden and put the finishing touches on the plot with a layer of compost. Have the finished compost sifted and in a bucket for the kids to help spread. Parents/caregivers can help spread the compost as evenly as possible over the beds. Kids can use small garden tools to mix it in to the soil below.

Emphasize that we are creating a mix of soil that contains all the food plants need to grow big and strong. What do we need to grow big and strong? Is compost kind of like milk and veggies to us?

Use the Mr. Mister (or animal cans) to water the plot really well, but gently. Some kids can water; others can help find small sticks in the mulch.

We will need to collect a few piles of sticks. These will be used to mark the places we put the seeds.

Give each kid a pinch of radish seeds and have the parents/caregivers help them use a stick to dig a shallow hole, plant the seeds, cover and mark a stick. Once everyone has a chance to do this, give them a few pea seeds to plant in the middle of the plot, keeping in

mind the plot layout as designated with Nicolette. After the planting is done, water well again and if there is some time left over, take a short tasting tour through the garden.

Class 2: Potting Plants

Materials: peat pots, vermiculite, compost, bucket for mixing soil, popsicle sticks, markers, seeds, watering cans, aprons, hot water for tea, cups, pocket knife

Also, rocks, stakes, and bird netting

Soil mixture: 1/3 compost; 1/3 peat, 1/3 vermiculite

Location: Outdoor kitchen, our plot, garden in general

Some plants need extra care to get started so we plant them in special starter pots called peat pots. Our broccoli, lettuce and peas can be started in peat pots and once they have sprouted, we can put them in the ground to grow big and strong. What do plants need to grow big and strong? Do they need milk and veggies like we do? Or do they need SUN, SOIL, and WATER?

First, spread the popsicle sticks out on the table and have the kids color them with markers for broccoli, lettuce, and pea stakes. The parents/caregivers can carefully write the veggie name (and the kids' names if desired) on the sticks.

After this activity, the parents/caregivers help arrange the peat pots in rows and then help the kids make the right 'soil formula' using the compost, soil, and vermiculite. The kids can fill the peat pots 2/3 of the way to the top with the mix they just made. Once this is done, they can carefully make a hole in the center of the soil and put the seeds in the holes and cover the holes with a little more soil mix. Stick in the popsicle stick markers and VIOLA! We have starts.

Once the peat pots have seeds, we can carefully water the pots and then the kids and parents can move the pots to the place we will leave them in the garden to sprout.

If there is any time left over, we can go through the garden and look at plants of different sizes. What does a sprout look like? What about an adult plant? Tasting is always OK.

Class 3: Trellis Making!

Materials: sticks (9 or so), paints, yarn,

Location: Garden in general, our plot

This week we will make a trellis for our peas. This is really important because plants don't have bones like us to help them stand up tall when they need to. Sometimes they need extra support and we will make that for them today.

Everyone spread out and collect a total of 9 tall, thin sticks (depending on the number of kids, each kid can find more than one). Have them bring the sticks back and lay them in a pile. Make sure they are all about the same height and thickness.

Sit the kids done next to the garden plot and provide paints, markers, and yarn. Let them go wild with their designs, etc. After about 20 minutes, see how far along they are. When finished, help them build the simple trellis in the middle of the plot where the peas have been sown.

While the kids are creating, have the moms make small snacks of tomato, basil leaves, and mozzarella. As the kids finish, they are welcome to eat the snacks.

If there is any extra time, have the kids identify what plots look like they need some extra attention. What could that mean? Do any of the plants here need extra compost/food? What about water? Are there plots that look like they need weeding? We can spend our extra time helping out in other places in the garden.

Class 4: Garden Scavenger Hunt (half way point)

Materials: Veggie cards; bowl, knife,

This class is designed to help kids identify additional fresh foods they may enjoy by having them find the veggies/fruits/herbs for us in the garden. Moms will be armed with bowls and forks, the teacher with a pocket knife to harvest and kids will have a chance to pick the veggie cards and then try to find the food on the card in the garden.

Once all of the veggies and fruits have been located and harvested, we will combine them for a yummy snack- a salad. Have tea and water available as well.

Class 5: Friends of the Garden

Materials: Magnifying glasses, small dishes, butterfly nets, bird, insect, reptile books?

What is so important about birds, bees, and lizards? This class is designed to explore the other animals that live in the garden. What's good for the garden and what is not?

Look for different kinds of birds, what are they doing? Do they live here or somewhere else? If they live somewhere else, why are they here?

What are they eating? Bugs? What kind of bugs? Use the magnifying glasses to get on the ground with the kids and explore what is underneath the leaves, in the compost, etc. Do the bugs live here? Where are all the places the bugs live (air, leaves, ground, underneath, flying in the air, etc).

What else do we see? Lizards, snakes? What are they doing? Do they live here?

What else? Is there anything else that lives here but only comes out at night? Why?

Worm exploration- use a trowel and find some worms in the ground. Why do they live there? What's so special about them that they live under ground? What do they do for us? Why are they so important to nature?

HOMEWORK: Next class is the last class- please come prepared to thank your favorite thing that we looked at, explored, tasted, studied over the course of the series. It can be anything from the bugs to the tomatoes.

Class 6: Garden Festival! (last class)

This thank you event is designed to help kids begin thinking about all the wonderful things that come from a garden.

Have materials (construction paper, markers, paints, etc for the kids to draw and illustrate their favorite things to present to the garden as a thank you. The drawings can be laminated and hung in the garden for all to see afterwards.

While the kids are drawing, we can make solar oven goodies, mini pizzas or solar nachos. Both are easy, ask they kids the class before which they prefer.

Some Basic Tips for Gardeners Working with Kids

- A picture is worth a thousand words. Never tell kids something you could show them.
- Young kids have a very short attention span. Make sure that you have lots of options available so they can get started immediately and stay busy. Digging holes is one thing that seems to hold endless fascination.
- Instant gratification helps a lot. Plant radishes even if you don't like them-they come up in three or four days.
- Growing their own will generally get kids to try eating things they otherwise wouldn't walk into the same room with.
- GETTING DIRTY IS AN INTEGRAL PART OF GROWING UP.

- Your role should be as facilitator, rather than as a leader who imposes direction. Be a good model.
- When giving out supplies to several kids, try to keep seeds, tools, etc. as similar as possible to avoid the inevitable squabbles.
- After an activity, do something to reinforce what everyone has learned. Talk about what went on, who did what, who saw what. If you can, have them write things down or draw pictures. If they're too young, take dictation.
- Many kids who won't talk in a large group will often speak easily in a small group.
- Plant garlic cloves (one small section will harvest a whole by the end of school), carrots, radishes, turnips, beets, mustard greens and flower seeds recommended for fall planting. Mulch heavy with hay when small plants to withstand cool weather. Pick radishes and carrots planted in the fall. Clean off and eat like Peter Rabbit.
- Mulch root crops heavily and water before a freeze.
- Prepare soil by turning with a shovel for the spring planting
- Make a root view box by cutting a side of a milk carton. Line with overhead acetate, fill with soil, and plant seeds close to side. Cover with black paper and take off to view.

Homemade Mozzarella Cheese
Ages 6+
Program time: 2 hours

I. Registration and Introductions (5-10 minutes)

I like to ask everyone what their favorite cheese is and what they like to eat wit with (good for groups that are mostly kids), or you can ask why they're interested in learning about making cheese.

II. An Ode to Milk and Cheese (10 minutes, in conference room)

- What is milk?
  - Food for baby animals. Animals that give milk are called **mammals**
    - What animals give us milk? Use photos.
    - A brief 30-second history of milk. Did anyone drink milk this morning for breakfast? Before that glass of milk hit your lips, did you stop to think about how AMAZING milk is? What if I told you that glass of milk was 8,000 years in the making?
  - The magic of milk:
    - Milk demo: jar of whole Jersey milk- if available
      - Raw (not pasteurized), Cream-line (not homogenized)
    - What is milk made of?
      - 87% water, 13% solids.
      - Solids: protein (casein, whey – it's what coagulates!, fat (butterfat), and sugar (lactose)
- Cheese!
  - THE FIRST CHEESE: About 8,000 years ago, after milk bearing animals were domesticated.
    - Nomad in the desert, put his morning's milk in a sheep stomach and plodded around, only to find it solid at lunch time!
    - Cheese basics: Add a *coagulant* to heated milk. The protein part of the milk solids *coagulates*. At first curd is soft because it still has much of the water, but as it drains it becomes more solid.
  - Why did cheese catch on? In the era of pre-refrigeration, cheese lasted way longer than milk. Now, because it tastes good!
  - So why over 300 types of cheese in U.S. alone? *time, temperature, bacteria (friendly!)*

        - Hard – cheese ripened over months or years, with introduced bacteria
        - Soft – little aging process

III. Cheese making! Mozzarella and Chevre (50 minutes, in kitchen)
- **Remember to preheat the oven to 400 degrees**
- First: WASH HANDS!
- Mozzarella
    - Learn the basic steps to Mozzarella
        - Cheesy skit: Do you think making cheese is cool? Do you think making cheese is REALLY cool? Then it will be easy for you to learn how to make mozzarella cheese, because the four steps to making cheese are…
            - RIPENING: Add citric acid to cold milk
            - RENNETING: Heat milk to 86 degrees, add rennet
            - CURDS! Messy squeeze time
            - CHEESE!
        - Pass out red cards that talk about the four steps, and let them read out loud.
    - Designate volunteers:
        - Two people with really strong arms: our stirrers
        - One measurer
        - One "coagulator" to add the "coagulant"
        - Ask for more volunteers during the process
    - Make cheese! There will be a few downtimes – when you are letting the milk heat up, and also when the curd is setting. Answer any questions.
    - When the curd has been set and cut, put it in a colander over a bowl so it can drain. Then bring it to the other room for snack time.
- Chevre: We don't' actually make chevre for the program, because it takes too long. (You can ask them if they want to make chevre, and then ask if they brought a sleeping bag to stay here for 2 days)
    - RIPENING: Heat milk to 86 degrees, add starter (bacteria)
    - SLOOOOOOOW CURDS: 6-12 hours, or more!
    - SLOOOOOOOW DRAIN: Drain for 12 hours
    - CHEESE!

IV. Snack time! (30 minutes)
- Everyone grabs a plate, a bowl and a spoon.
- Snack 1: Mozzarella Pizzas

- Finishing the mozzarella: time for the messy part! Everybody takes a bit of curd and squeezes the whey out over a bowl. Go away whey! Then wash hands again.
- Let everyone have 1 or 2 mini-pitas, pass around bowls of tomato sauce. Let them sprinkle their fresh cheese on top! Encourage them designs with their cheese so they know which one is theirs.
- Put in the oven for approximately 5 minutes. It's great if you have a volunteer to help look after the pizzas. While everyone is waiting, move onto the chevre activity.

❖ Snack 2: Goat Cheese on Crackers

- Have the fresh chevre on a plate with knives for spreading with the fresh herbs so they can season their own chevre. Enjoy with crackers. Yum!

V. Conclusion

❖ Eat!

❖ Hand out Cheesy activity booklets and other program fliers.

Home Cultivation of Culinary Mushrooms
Pleurotus ostreatus, Oyster Mushrooms
Ages 16+
Program Time: 3 hours

I. Cultivation in a Nutshell

Materials - Mushroom spawn, pasteurized straw, bags, knife, alcohol, hydrated lime

A. Heat water to 180 degrees. Add water and straw (in a pillow case or a sheet), pasteurize for 90 minutes, maintain temps around 160 degrees.

B. Remove from water, drain, and spread out on clean table. Allow to cool for 2 hours. Ensure temperature of straw is around 80 degrees.

C. Add straw to bottom of bag, packed in nicely, then add layer of grain spawn, add another layer of straw, then grain. Repeat till full.

D. Once packed tightly, squeeze bag in a downward motion to pack straw down, tie off the bag and pierce with knife.

After 2-3 weeks fruiting should begin.

Several strains of gourmet mushrooms can be grown on pasteurized straw, including several types of oysters, portabellas and some strains of shiitake. Straw cultivation is the easiest and cheapest method to get new growers started due to the easy, low-tech methods that are often used, with only a 55-gallon drum, a mesh basket or pillow case to f it the drum, a propane burner, an easily cleaned table (preferably stainless steel), and grain spawn.

II. Cultivation In Detail

Step 1
Typically, a 55 gal drum is filled ¾ full with water and heated by a burner attached to a propane tank. When using a drum, usually a basket made of ¼" hardware cloth is constructed to fit inside the drum. It is ideal to use chopped straw between 1" to 3" in length, but this is not absolutely necessary.

The straw is then stuffed into the basket or pillow case. Once the water starts to boil and reaches 160 -170 degrees, the straw is placed in the water

and pasteurized for 1 - 1.5 hours. During this time, the water is maintained at a slight boil. Pasteurization will eliminate all insect life, living fungi and most types of bacteria. Many spores and heat-tolerant bacteria will survive. Heat-tolerant bacteria tend to have a beneficial relationship with many types of mushrooms.

What we will focus on is getting the water to a boiling point and then transferring the hot water into a large container and maintaining a temperature around 160 for 90 minutes. We can also add hydrated lime to the straw water mix. This will raise the PH to about 12 which will give the straw more time to colonize before any contaminants can establish and overtake the mycelium.

Step 2
After 90 minutes, raise the straw out of the water and allow it to drain into the drum (or ground) for ten minutes. This can be done by placing two 2" x 4"s on top of the drum to rest the bundle on. Then, spread the straw out on a clean table and allow to cool. The cool down can last up to 2 hours. We want the temperature of the straw to cool to 80 degrees. **Don't worry about contaminants landing on your straw; Millions of them will, but with the high ph of the straw, they won't be able to grow for at least two weeks, and your straw will be pinning by then anyway. By that time the mycelium will be strong enough to fight off all invaders. **

Step 3
Once the straw is cool, it is inoculated with grain spawn by mixing the spawn evenly into the straw. The straw must be inoculated with an adequate amount of spawn to insure that the straw will be colonized within 7 to 10 days. If the straw is not colonized within that time period, contaminate can take over the straw. A heavy inoculation rate of one 5 lb bag of grain spawn to one 40 lb straw bag, usually results in much lower contamination rates and significantly higher yields. The inoculated straw is pressed into a plastic bag and then a layer of spawn is mixed in. Please be mindful to only spread the spawn into the center of the bag and avoid the edges. You will alternate adding layers of straw and spawn, packing in the straw very well.

Step 4
After the bags are filled, use a sterilized knife to poke holes all over. This helps create high humidity while still allowing the fungi and straw to breathe. At home, place or hang the bags in a bright room with indirect sun. The bags will colonize for about 10 days. Check every other day to

see if moisture conditions are being kept up, if it seems a bit dry then with a very f ne indirect mist water the straw.

Wait for fruits to appear. Harvest prior to spores being released and enjoy the ‘fruits’ of your labor!

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