CONNECTING LIVING AND LEARNING ABOUT SUSTAINABILITY: INSTALLING AN EDIBLE FOREST GARDEN IN CAMPUS HOUSING AT THE EVERGREEN STATE COLLEGE

by
Natalie Pyrooz

A Thesis
Submitted in partial fulfillment
of the requirements for the degree
Master of Environmental Study
The Evergreen State College
November 2009

This Thesis for the Master of Environmental Study Degree

by

Natalie Pyrooz

has been approved for

The Evergreen State College

by

_____

Frederica Bowcutt, Ph.D.
Member of the Faculty, The Evergreen State College

_____

Edward A. Whitesell, Ph.D.
Member of the Faculty, The Evergreen State College

_____

Timothy Hohn
Member of the Faculty, Edmonds Community College

_____

Date

ABSTRACT

Connecting Living and Learning About Sustainability:
Installing an Edible Forest Garden in Housing
at The Evergreen State College

Natalie Pyrooz

Through gardening, people can attain closer contact with the land and natural environment. Higher education institutions have been initiating changes in their curriculum and operations reflecting their growing acceptance of the sustainability movement. Edible forest gardens offer a sustainable approach to landscape interaction, as they are based on ecological principles while concurrently producing food. This case study focuses on the installation of an edible forest garden in the residential area of The Evergreen State College in Olympia, WA. It explores the questions: a) how can edible forest gardens influence student learning about sustainability and food issues, and b) can edible forest gardens be an important solution in a campus sustainability plan?

Data was collected using interviews with the campus and greater community, and with pre-and post-surveys collected from students in a participating class program. Results indicate that edible forest gardening workshops positively affected students' learning about sustainable food production. The addition of the garden to the campus was seen as a sustainability project that addressed many of the campus' sustainability goals, and encouraged both student and institutional learning opportunities through collaboration between students, faculty and staff. Edible forest gardens were seen as addressing several sustainability issues, including: land use, ecology, food systems, ethnobotany, and bioregional concepts. Perceived benefits of the garden included: support of teaching and learning, further connecting students to place, and establishing student feelings of ownership. It also serves as an example of sustainable grounds maintenance. However, many challenges exist in establishing perennial food producing gardens on campus, particularly in regards to continuity and long-term maintenance, and require careful planning to address.

This study can serve as a model for other campuses seeking methods of actively bringing sustainability into their grounds and operations as well as their curriculum. It also demonstrates ways in which gardens can serve as a teaching tool at the higher education level.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

LIST OF ACRONYMS

AASHE	Association of Advancement for Sustainability in Higher Education
ACUPCC	American College and University Presidents' Climate Commitment
CLUC	Campus Land Use Committee
EFG	Edible forest garden
FAO	Food and Agriculture Organization
LEED	Leadership in Energy and Environmental Design
RAD	Residential and Dining Services
STARS	Sustainability Tracking Assessment and Rating Systeme
TESC	The Evergreen State College
UNESCO	United Nations Educational, Scientific and Cultural Organization

ACKNOWLEDGEMENTS

Without the support of many people this work could not have been accomplished. I want to extend my gratitude to all of those who participated in this project: it has strengthened me academically, in my personal growth, and will hopefully contribute to research that will cultivate a greater sense of caring for the earth.

I would like to thank:

Michael Kelly, Pat Rasmussen, and Laura Donahue of Terra Commons for sharing their knowledge and inviting me to participate in so many aspects of their work, and for helping me to access tools and resources as I embarked on this work;

the Campus Land Use Committee (CLUC) for approving the project;

the students of Food, Place, and Culture for enthusiastically participating in the installation;

Martha Rosemeyer, faculty for Food. Place, and Culture, for inviting me into the classroom and sharing ideas and excitement;

Mark Lacina and Sharon Goodman of Residential and Dining Services for the opportunity to develop myself, and the guidance and support they've provided throughout this process, and for creating a graduate student position to grow sustainability;

Sam Lanz and the Residential and Dining Services Grounds Crew, for maintaining the garden and installing paths and drip irrigation;

Abigail Marshall, for enthusiastically engaging in a collaborative learning process, and for seeing this project forward as I move on;

Phred Swain-Sugarman for documenting the volunteer workshop in film,

all volunteers who came to any of the work parties;

Halli Winstead, who has been a wonderful sustainabilabuddy and incredibly special collaborator in growing sustainability at Evergreen this year;

I want to thank each person who agreed to be interviewed; their words and thoughts contributed insight into this process;

my advisors, Frederica Bowcutt and Ted Whitesell, Members of the Faculty at the Evergreen State College, and Tim Hohn, Professor at Everett Community College, for their support, critique, and guidance throughout the entire process. Each of you brought different but essential knowledge to the table, and this work would not have come together as thoroughly as it has without your assistance. I particularly am indebted to Frederica's dedication, creativity, and encouragement as my primary advisor, and appreciate our countless conversations which helped to shape this work;

Thanks to my brother, David Pyrooz, who is an inspiration through his own dedicated research, my stepfather Jim Fish, for always believing in me and being interested in my work, my mother, Marion Lafler, who has always encouraged me to achieve even the highest of goals, and my father, David Pyrooz, who I know would be so proud;

And most deserving of thanks is Jameson Honeycutt, who has experienced graduate school through me, listening to my excited highs and feelings of discouragement, who cooked many dinners so that I could continue working uninterrupted, and who has demonstrated his love and dedication.

Chapter I | Introduction: An Edible Forest Garden at The Evergreen State College

Gardening brings people closer to the land, through working the soil, observing things grow, and reaping the rewards. It can also be a step in the movement towards sustainability: not only does growing one's own food reduce miles traveled between food origin and consumption, it also teaches the gardener about the natural environment. College campuses are rapidly advancing the forefront of sustainability research and education, and have the opportunity to concurrently improve their operations (Cortese 2003). As institutes of higher education make these changes to their curricula and operations, they are compiling cohesive plans to determine their pathways towards sustainability.

Edible forest gardens (EFGs) provide a unique opportunity to connect gardening with sustainability in higher education. Most other studies have focused on gardens in an educational context at the K-12 level, and typically feature annual vegetable gardens (Civil 2007, Graham et al. 2005, Graham and Zidenberg-Cherr 2005, Higgs and McMillan 2006, Morgan et al. 2009, Ozer 2007), though a few highlight teaching gardens on college campuses (Hamilton 1999, Mkinne and Halfacre 2008, VanDerZanden and Cook 1999). Some college and university campuses feature some sort of food production on their grounds (i.e. Oberlin College, Sterling College, Warren Wilson College), and many have developed sustainable landscaping plans and objectives (AASHE website, accessed September 22, 2009). These plans often call for grounds to be managed to: minimize inputs and outputs, eliminate or minimize pesticides, conserve water, highlight native species, include species important for pollination, and/or create natural wetland or forest areas. Edible forest gardens consist of diverse assemblages of primarily perennial food-

producing species. Defined by several vertical layers of plants performing multiple ecosystem functions, edible forest gardens mimic forest systems and are largely self-maintaining, while providing prime habitat features for wildlife.

The focus of this research is to determine whether edible forest gardens can result in sustainability learning and living at both the institutional and the student scale. My research focused on a two-part question: Can edible forest gardens on a college campus facilitate sustainability (a) through teaching and learning with students both in and out of the classroom, and (b) for the campus community, as a component of a campus sustainability plan? I assert that EFGs in campus housing are an important component of a campus sustainability plan. Gardens can create cross-institutional relationships between campus groups, requiring collaboration and participation with facility operations. Many challenges and opportunities arise when executing a campus project, and the process of garden installation is enlightening for other institutions incorporating gardens into their sustainability plan. The installation process creates a hands-on learning experience that cultivates a deep sense of meaning about food and place, raises awareness about sustainability issues in food systems, and develops a sense of community.

A Case Study at The Evergreen State College

This case study is focused on the installation of an edible forest garden in the housing area at The Evergreen State College campus, and its direct and indirect effects on learning about sustainability. Evergreen is a unique campus, both in its pedagogy and operations. However, it presents many of the same sustainability challenges that are encountered in other college campuses as well as large-scale institutions. The case study will provide insights to the importance of landscaping

with edible plants in a public setting, and the educational opportunities that occur both within and outside of classroom learning.

Chapter Outline

Chapter 2 will review and critique the campus sustainability movement, in particular as it pertains to the Evergreen State College. Next, Chapter 3 will consider current literature and posit the importance of edible forest gardens as an ecological alternative for growing food and grounds management. Chapter 4 discusses and justifies methodology: I speak to the methods used to collect the data, further justify the case study method, and outline my limitations. After that, Chapter 5 presents the findings from the research. Lastly, Chapter 6 will open into discussion on what the research means for the institution itself, as well as in a wider context.

Chapter II | The Sustainability Movement on College Campuses

> Higher education has unique academic freedom and the critical mass and diversity of skills to develop new ideas, to comment on society and its challenges, and to engage in bold experimentation in sustainable living.
>
> Anthony Cortese 2003

Although colleges and universities are notoriously slow to create changes in curriculum (Altbach 1974), these institutions are in a unique position to emerge as leaders in the sustainability movement (Cortese 1992). There are several reasons for this: they are centers of teaching, learning, and research and as a result they have the potential to equip the next generation with skills and concepts for the future (Cortese 2003). In addition to realized outcomes and educational process, sustainability challenges the foundation upon which institutions of higher education are built, and can be a catalyst for curricular and operational innovation (Corcoran et al. 2004). Many campuses constitute an all-inclusive system: with food services, housing, employment, and leisure (M'Gonigle and Starke 2006). Ranging in size from less than 1,000 to over 40,000 students, colleges and universities have the opportunity to confront a wide range of sustainability challenges at different scales.

Campus Sustainability

Several benchmarks have led to the increased acceptance and integration of sustainability recognition in higher education (Wright 2002). In 1972, the Stockholm Declaration recognized the interdependency between humans and the environment, offering 24 principles to attain sustainability, including a clear message outlining the need for environmental education (UNESCO 1972). However, it wasn't until almost 20 years later, in 1990, that university administrators made their first commitment to sustainability in higher education with the Talloires Declaration, asserting

the need for universities to assume a leadership role in advancing sustainability (UNESCO 1990). Several other declarations were developed throughout the early 1990s and incorporated to various extents at universities around the world (Wright 2002). The Thessaloniki Declaration in 1997 became the first to argue the essential place of sustainability learning within all disciplines, and clearly link ecological sustainability with social responsibility (UNESCO 1997). The most recent higher education sustainability objective is the American College and University Presidents Climate Commitment, to which there are over 600 signators, focusing sustainability efforts on the daunting task of addressing climate change (ACUPCC 2008).

In the last several years, sustainability has become a buzzword in higher education, and an unprecedented number of schools are jumping on the bandwagon (AASHE website, accessed April 17, 2009). The Association for the Advancement of Sustainability in Higher Education (AASHE) consists of 647 member schools from across the nation (480 four-year and graduate institutions, and 167 two-year and community colleges). Demonstrating the still-growing movement, 21 new members joined in February 2009, 12 in March 2009, and 11 in June 2009 (AASHE website, accessed April 17, 2009). Prospective students often consider a campus' sustainability efforts as they are make decisions about where to continue their education: 66% of college applicants indicated that a college's environmental commitment weighed upon their decision-making in choosing a school (Princeton Review 2008). Distinguishing a campus' dedicated efforts at ecological and social responsibility from one that is merely "greenwashing" to attract prospective students (i.e. signing the declarations and not taking sincere action) can sometimes be difficult.

However, comprehensive assessments are under development to measure campus sustainability efforts. At the forefront is AASHE's Sustainability Tracking, Assessment, and Rating System (STARS), a tool to gauge campus' progress in their sustainability efforts. Since sustainability is a developing area of research, there had been no tracking system to compare or rate progress in this area (AASHE website, accessed April 17, 2009). By assigning credits, STARS generates a 'report card' of campus sustainability, evaluating three broad areas: education and research, operations, and administration and finance. Within these categories, specific areas examined include curriculum, faculty and staff development, buildings, grounds, dining services, waste minimization, purchasing, transportation, planning, affordability, and sustainability infrastructure (AASHE 2008). This comprehensive tool was piloted by 66 colleges and universities, including Evergreen, in the United States and Canada in 2008, and its revised version was released in April 2009. Evergreen's pilot assessment was coordinated by graduate student Kyle Murphy, whose thesis concluded that not only did the tracking tool serve as a benchmark of indicators for the school's sustainability efforts, but also assisted in organizational learning by the institution about sustainability (Murphy 2009).

Gardens and Campus Sustainability

Many colleges and universities are struggling to incorporate sustainability concepts and operations into their institutional paradigm and communicate them across distinctive populations of students, faculty, and staff (Sharp 2002). There are several avenues through which sustainability can be incorporated into the campus culture. These include: curricular integration to existing disciplines, operations and facilities, dining, housing, recreation and student life, and at the administrative level (Creighton 1999, M'Gonigle and Starke 2006). Each of these areas presents its own suite of challenges. As this thesis will demonstrate, the addition of edible forest

gardens to campus grounds can both teach and demonstrate sustainability at several of these intersections.

Gardens arise as one tactic in promoting sustainability practices in operations and curriculum, and many schools are installing variously-themed gardens on their grounds. Of 88 campuses that have submitted applications to AASHE's Campus Sustainability Leadership Awards, 43 of them highlight gardens (AASHE website, accessed April 22, 2009). These include many types of gardens: native plant gardens, rain gardens, rooftop gardens, organic gardens that provide food to the campus food service provider, community gardens which are tended by students or community members (AASHE website, accessed April 22, 2009). The functions served by these gardens included food, demonstration and education, habitat or restoration value, and reducing water use. Gardens typically were addressed within either campus operations or student life, depending on who is responsible for caring for them. Some spaces are maintained by grounds maintenance staff, whereas others are cared for by student groups. Maintenance is one determining factor in assessing the potential for teaching about sustainability through ongoing interaction with the garden. Oberlin College has installed edible landscaping on the grounds of their environmental building, which includes annual and perennial gardens demonstrating the food capable of being produced in urban and suburban areas. At Warren Wilson College, the landscaping crew and residents maintain a permaculture garden for vegetables, fruits, and herbs by the EcoDorm.

Edible forest gardens, due to their holistic approach and design, do not fit into the confines of a traditional academic discipline (Jacke and Toensmeier 2005). Rather, when integrated into curricula, they can reach across multiple branches of learning. The Curriculum for the Bioregion Initiative, nationally recognized for working with

educators across disciplinary boundaries to bridge sustainability into curriculum, recommends bringing sustainability into existing disciplines rather than define disciplinary confines for the subject itself (The Washington Center for Improving Undergraduate Education 2008). The Initiative's philosophy is rooted in re-orienting the curricula of majors, minors, and general education, designing interdisciplinary curricula, and integrating community-based or service-learning opportunities into existing courses (The Washington Center for Improving Undergraduate Education 2008). Because of their place-based nature, edible forest gardens are particularly effective in communicating bioregional concepts. Since they are tangible, they can create a hands-on learning experience.

Sustainability At The Evergreen State College: Successes and Struggles

The Evergreen State College (TESC or Evergreen) is widely considered a leader in sustainability. Despite the recognition the campus has received, it is struggling in determining how to proceed in developing a sustainability ethic, and become a truly carbon neutral, zero-waste campus. There is not room in this work nor is it my intent to comprehensively describe or assess Evergreen's sustainability programs, but providing a clear picture of some of the current highlights and challenges will set the stage for understanding how edible forest gardens fit into the bigger picture of sustainability on this campus.

A set of goals and strategies was outlined in 2006 to lead the campus towards sustainability: while most are in progress, some are not on target to being met. These include specific targets, i.e. "Increase local/organic food purchases to 40% by 2010," as well as broader approaches, for example, "Increase opportunities for a practical education in sustainability." A Climate Action Plan, compiled by a collaboration of students, faculty, was completed and approved in summer 2009 and

submitted to the American College and University Presidents Climate Commitment (TESC 2009a). One of the goals included in the plan is to re-purpose designated lawns and underutilized areas with forest and garden space. Edible forest gardens established in some of these areas will further demonstrate commitment to sustainability, and provide a link to the curriculum.

Evergreen has been the recipient of several awards in regards to the campus' sustainability efforts. For example, the National Wildlife Federation considered Evergreen to have an 'exemplary' sustainability program (NWF 2008). The Princeton Review awarded Ev ergreen a 99 (on a scale of 60-99) in its Green Rating of colleges (Princeton Review 2009). The college was one of the first signatories to the President's Climate Commitment in 2007. Evergreen hosts the first publicly funded LEED Gold public building in Washington, including green features such as recycled wood floors, green roofs, and passive solar designs (TESC website, accessed October 2, 2009); purchases 100% chlorine-free recycled paper; and uses Green Seal approved cleaning products. The student-initiated Clean Energy Committee collects student fees to purchase green energy tags to offset 100% of campus energy use

Photo 2.1 *Seminar II Building at TESC*. The Seminar II building earned LEED gold standard. This photo illustrates stormwater drainage that incorporates a themed teaching Garden, and outdoor hallways eliminating the need for additional lighting and temperature control. Photo credit: Lara Swimmer.

with renewable energy sources and fund sustainability-related projects. The Organic Farm on campus composts food waste from the campus housing area, and other compostables collected across campus are taken to Silver Springs Organics, a local composting facility.

While much progressive action is being taken and there is considerable good publicity, there is room for critical assessment of Evergreen's progress. For example, the commercial compost program is laden with obstacles, and an established plan for operation of this is still under construction. While 82% of residents claimed to understand the recycling and composting systems on campus, 80% of materials found in a campus waste audit were compostable or recyclable (Raab 2009, TESC 2009b). Evergreen is struggling to meet another large-scale goal of purchasing 40% local and/or organic food; while the campus has reached approximately 33%, the last 7% is currently prohibitively expensive (Field notes 2009). The rural setting of the campus presents a challenge in reducing its transportation-related carbon footprint. Sustainability-themed student housing has yet to develop a successful program.

Evergreen supports a Sustainability Office, formed in 2008, that is situated within the President's Office, under the supervision of the Sustainability Director. A Sustainability Council, consisting of faculty, staff, upper-level administration, and student representatives, make campus-wide sustainability-oriented decisions. Four working groups, focused on outlining and achieving goals related to food sustainability, alternative transportation, energy, and waste reduction, consist of faculty, staff, and students, who regularly attend Council meetings to report progress and make recommendations. The interdisciplinary structure of Evergreen's curriculum favors integration of sustainability concepts. The 2008-09 catalog highlights 19 full-time programs directly focused on sustainability studies, exploring

such varied disciplines as community planning, social justice, food and agriculture, ecology, history and culture, policy, economics, and business (TESC website, accessed April 22 2009).

The Greener Living Program seeks to instill an ethic of sustainability on the college campus, and supports several programs engaging students through curricular and extracurricular activities, and providing solutions to create a more sustainable lifestyle. Situated primarily in campus housing, the program endeavors to create a place for students to practice sustainability in their own lives. The campus Residential and Dining Services (RAD, or RAD Services) at Evergreen includes "Sustainability" in its mission statement, attempting to create meaningful space for students to live sustainably. RAD Services engages a Sustainability Theme House, partners with the Organic Farm to help residents compost, uses eco-friendly materials in remodel projects and attempts to donate or recycle all materials, has purchased electric vehicles for campus driving, utilizes Clear Stream recycling from Thurston County Solid Waste, and uses a suite of certified green cleaning products. They have created Kitchen Garden raised bed plots, collaborated with the Community Gardens to organize seed planting workshops, and installed an edible forest garden. To achieve these goals, they have created a student Sustainability Coordinator position, which I filled in the 2008-09 academic year, to further research and implement ways in which the campus could become more sustainable. The edible forest garden installed in the spring of 2009 is the focus of this research.

Edible Forest Gardens in a Campus Sustainability Plan

In 2002, an arboretum plan was established and approved by the CLUC and the faculty for the installation of eleven teaching gardens throughout the campus core, in addition to the pre-existing Longhouse Ethnobotanical Garden initiated by

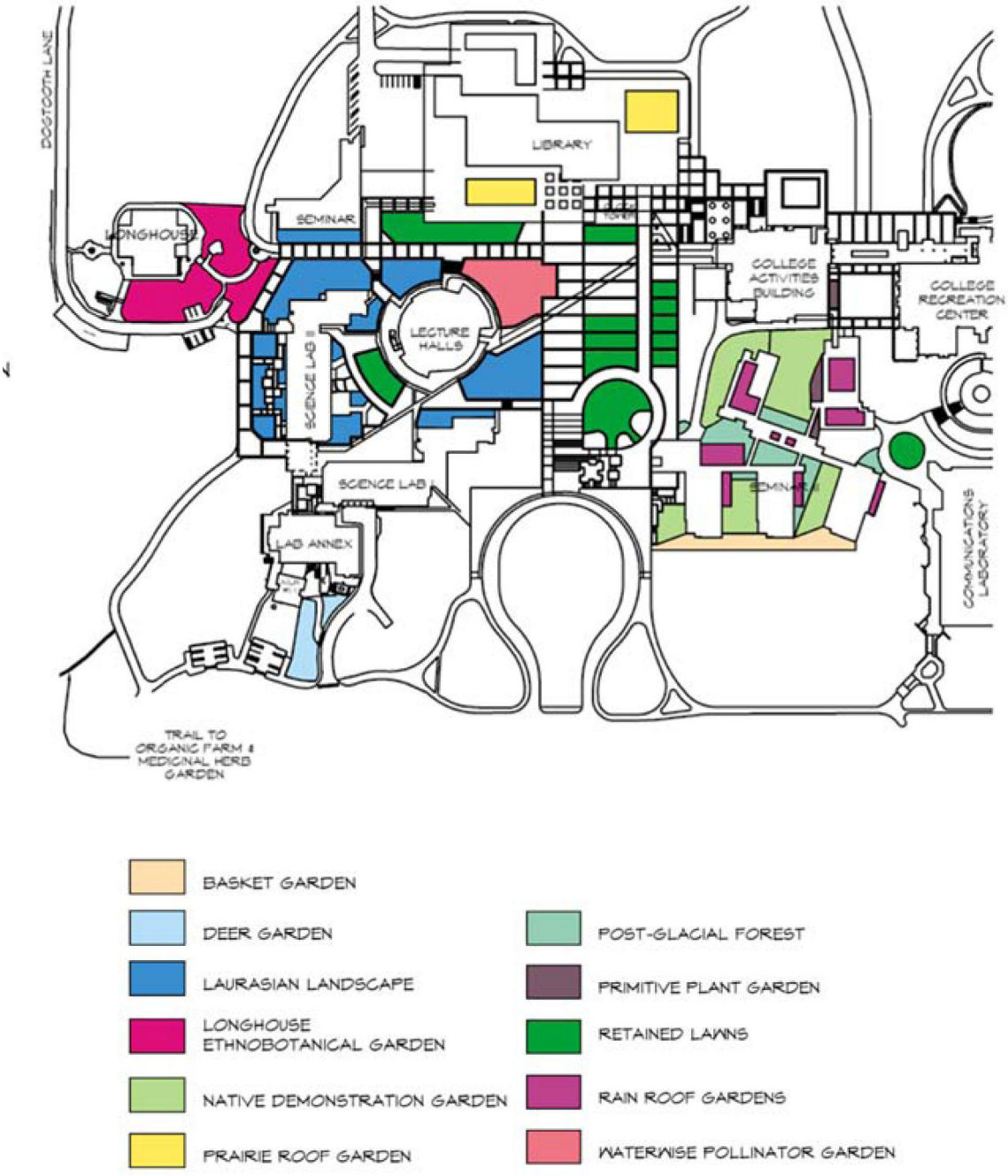


Figure 2.1 *Map of Evergreen's teaching gardens* (Bowcutt 2008)

faculty member Marja Eloheimo (Bowcutt 2002). The plan was updated in 2008 and added to the current Campus Master Plan's appendices (Bowcutt 2008). Goals of these gardens are both social (educational value, aesthetics, celebrating cultural diversity, fostering social justice) and environmental (promoting sustainable garden

design, reduction of water and energy use, improvement of wildlife habitat). Though proposed and established prior to Evergreen's formal foray into developing campus sustainability measures, these gardens act as a step towards sustainability. Twelve teaching gardens have now been established, and are a result of collaborative partnerships between faculty, staff, students, alumni, various campus entities (i.e. the Organic Farm, the Longhouse), and the greater community (Bowcutt 2008). Partners outside the campus community include government agencies (the City of Olympia, Washington Department of Transportation, Washington State University's cooperative extension program Native Plant Salvage), non-profit organizations, and for-profit organizations. The gardens have several themes, including native plants, ethnobotany, rain gardens, pollinator gardens, and roof gardens (Bowcutt 2008). The edible forest garden theme complements that of the other gardens as it expands the scope of teaching and learning to include edible foods in Evergreen's Teaching Gardens, while falling in line with the pre-established goals outlined above.

As Evergreen institutionalizes sustainability, the Climate Action Plan will outline strategies for the next 10 years. Currently under development and review by the Sustainability Council, the Climate Action Plan rigorously reviews the campus' carbon footprint, establishing concrete steps to achieve carbon neutrality (TESC 2009a). The goal to re-purpose several lawn areas into edible or native forest will reduce maintenance, particularly by greenhouse gas-intensive equipment like lawn mowers and leaf blowers. It will also increae carbon sequestration and ecosystem services, as well as create educational opportunities (TESC 2009a). The next chapter looks more closely at what edible forest gardens have to offer, and how they intimately connect to sustainability principles and practices.

Chapter III | Edible Forest Gardens

> Conservation is a state of harmony between men and the land. By land is meant all of the things on, over, or in the earth. Harmony with land is like harmony with a friend; you cannot cherish his right hand and chop off his left. That is to say, you cannot love game and hate predators; you cannot conserve the waters and waste the ranges; you cannot build the forest and mine the farm. The land is one organism.
>
> Aldo Leopold, *Round River*

This chapter will review literature on edible forest gardens, explaining their principles, history, and connection to food sustainability, finishing with examples of gardens as teaching tools. I will first describe what edible forest gardens are and how their design philosophy concurs with forest ecology theory. Next, I'll show how land management similar to forest gardens has been used in various geographical areas throughout history. Then I will briefly review some current challenges in food sustainability, and link edible forest gardens as one solution considering more sustainable food production. Lastly, I will indicate previous literature that demonstrates how gardens have been used in teaching and learning.

Edible forest gardens are perennial polycultures of multipurpose plants (Jacke and Toensmeier 2005). While the majority of the plants are edible, all plants in the garden provide some sort of use: whether for food, medicine, culinary herbs, or other purposes. These intentional ecosystems utilize forest ecology principles, creating an environment that requires little maintenance and is largely self-sustaining. Distinctly different from typical methods of growing food, edible forest gardens are composed of diverse species thriving together, with several vertical layers as in a forest system. Weaving an edible forest garden into the fabric of

a college campus offers a demonstration of this alternative edible ecosystem, conveying sustainability concepts in both theory and practice.

The Ecology of Edible Forest Gardens

While the foundational concepts of edible forest garden design *do* mimic forest structures and patterns, the form of a forest garden can widely vary depending on factors such as: climate, geography, watering regime, soil, planting density, and suite of selected species (Jacke and Toensmeier 2005, Whitefield 2002). Two key distinguishing factors of a forest garden are (a) it is composed of primarily perennial species in untilled soil, and (b) multiple plant species are interwoven rather than segregated (Whitefield 2002). The structure of the garden can be wide-ranging depending on the designer's emphasis. For example, the Land Institute in Salina, Kansas conducts extensive research in using perennial species as substitutes for annual grassland crops in prairie ecosystems, (for example, Cox et al. 2006, Crews 2005, Glover 2005), demonstrating how the landscape can just as easily result in a grassland as a woodland. Several elements of forest ecology are pervasive in edible forest garden design: patterns, plant diversity, vertical structure, and soils (Jacke and

Table 3.1 *Selected list of differences between a typical farm or garden producing food and an edible forest garden*

Conventional Farming / Gardening	**Edible Forest Gardens**
Single species typically in rows	Multiple species interspersed
Primarily annual and some perennial plants	Primarily perennial and some annual plants
Tylically cultivated species and hybrids	Spectrum of fully native to fully cultivated species composition
Single layer	Multiple layers together
Requires inputs of fertilizer	Primarily self-fertilizing
Requires sun	Sun to shade
Requires irrigation	Often drought tolerant
Limited habitat for wildlife	Many niche habitats for wildlife

Toensmeier 2005, Whitefield 2002). The principles used in forest gardening are grounded in ecological studies of forest function, but are adapted to prioritize food production. I'll finish the section by distinguishing edible forest gardens from both permaculture and agroforestry, which share similar qualities.

Patterns. In contrast to rigid, single-species rows of plants in conventional agriculture or home food gardening, EFGs attempt to mimic ecosystem patterns. Species within a forest form communities based on a number of factors, such as site conditions, plant propagation and seed dispersal methods, water regime, and disturbance frequency (Barbour et al. 1999, Kimmins 2004). Plant arrangement is seen both at regular and irregular intervals, and in clumps or patches, clusters, drifts, or scattered. Benefits of plant placement following these techniques include increasing plant defense against herbivory and disease, and the reduction of competition between individual plants attempting to occupy the same niche (Liebman 1995).

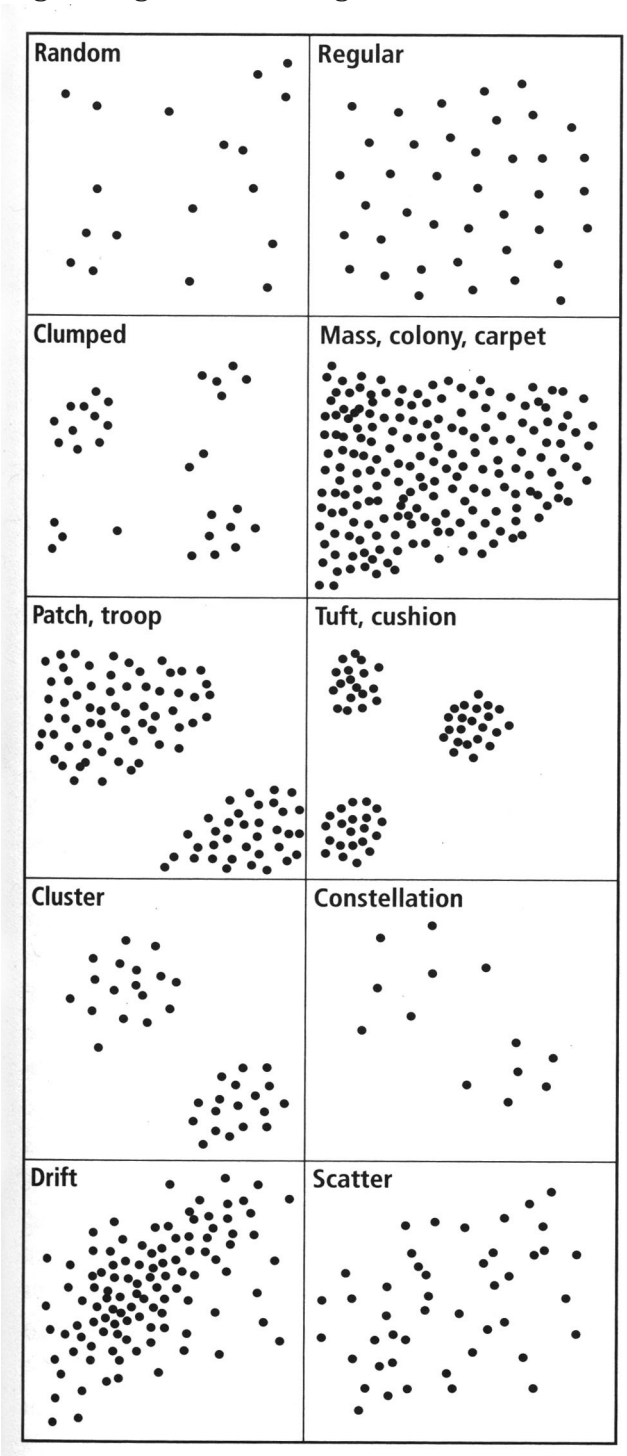


Figure 3.1 *Types of distribution patterns.* (Jacke and Toensmeier 2005)

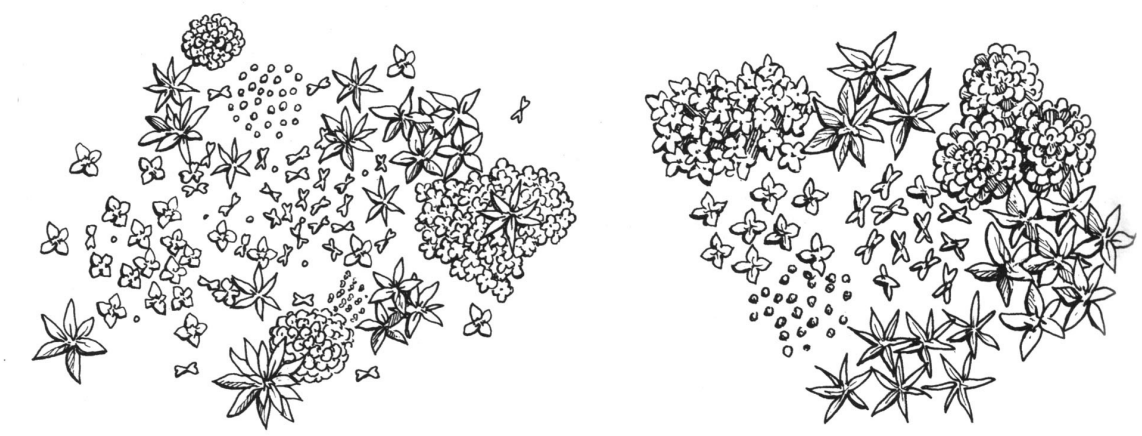


Figure 3.2 *Two examples of species distribution*. Left: multiple patterns are shown: clusters, drifts, scatters; Right: several clumps of species. (Jacke and Toensmeier 2005)

Consequently, diverse plant communities flourishing in similar site conditions can create alliances by promoting pollination interactions and building soil-based food web relationships. The spatial distribution patterns used in EFG design attempt to include community relationship patterns.

Diversity. Biodiversity contributes to ecosystem function, such as air and water purification, nutrient cycling, soil building, carbon sequestration, as well as meeting human needs, including crop pollination and providing natural resources (Chapin et al. 1997, Groom et al. 2006). Edible forest gardens embrace biodiversity at various hierarchical levels (genetic, species, and community) in an attempt to build a functioning ecological system (Jacke and Toensmeier 2005). Diversity of plantings encourages greater species richness of insects, birds, and other wildlife.

Vertical Layers. Forest systems exploit vertical space allowing multiple species to overlap in the same horizontal spatial area. Beard (1973) establishes six primary growth forms of terrestrial plants: trees, lianas/vines, shrubs, epiphytes, herbs, and thallophytes, as shown in the top illustration of Figure 3.3. (Note: though the term

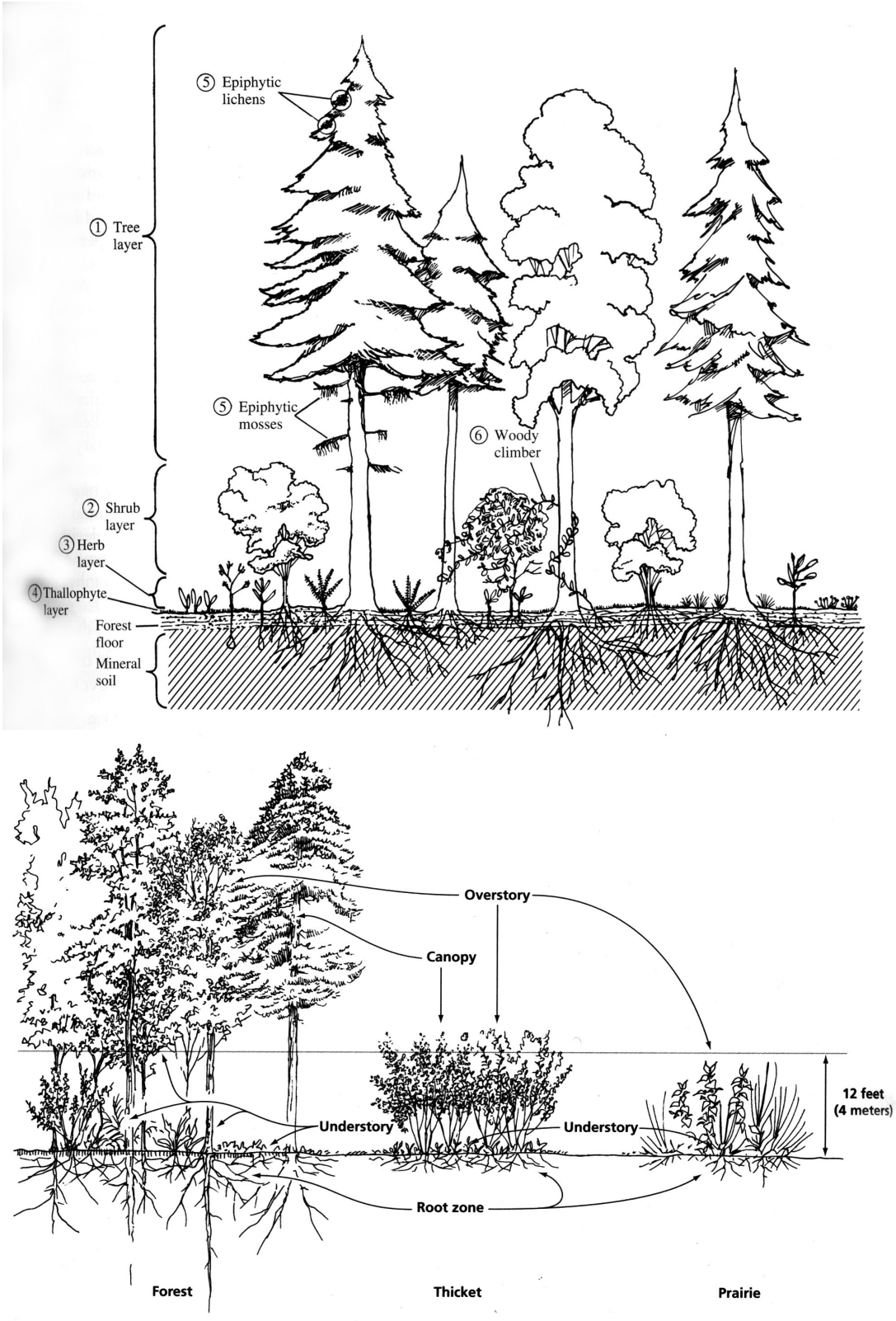


Figure 3.3 *Above: Vertical layers recognized in forest ecology texts.* (Beard 1973) *Below: vertical layers acknowledged in edible forest garden design texts*. (Jacke and Toensmeier 2005)

thallophyte is outdated, the designation of multiple vertical layers of co-existing species has been useful and remains valid.) Adapting this to edible forest gardens, Hart counts seven layers: canopy trees, understory trees, shrubs, perennial herbs, groundcovers, vines, and an underground root zone. Whitefield (2002) simplifies this to four: trees, shrubs, perennial herbs, and vines. The benefits of vertical layering are numerous: (a) it encourages a higher yield in a comparable area by occupying otherwise underutilized space (Soule and Piper 1991); (b) it promotes diversity by employing multiple species to satisfy specific niches; and (c) the varied structure creates wildlife habitat. Habitat structure has been found to be more important than vegetation composition in maintaining native wildlife assemblages, particularly in urban forest environments (Garden et al. 2007).

Soils. Conventional gardening and agricultural practices modify soil structure with frequent tilling and chemical inputs, which disturbs the sub-soil system. Petrochemical fertilizers require energy intensive production and are a contributor of nitrate additions to the soil that then infiltrate and contaminate water systems. Soil building in EFG design uses alternative approaches to fertilizers and tilling. Reduction of tilling reduces potential for erosion, allows for the soil strata to develop which enhances beneficial soil organisms, and encourages mycorrhizal growth (Soule and Piper 1992). Substituting petrochemical fertilizers with compost and mulch minimizes weeds and encourages mycorrhizae. Wood chip mulch helps to improve soil structure, enhance gas transfer, enhance water infiltration and retention, prevents erosion and compaction, and moderates temperature; additionally it provides plant nutrients, suppresses pathogens, and enhances beneficial organisms (Chalker-Scott 2007). Additionally, edible forest gardening encourages the inclusion of nitrogen-fixers and “dynamic accumulators” to build soil health (Jacke and Toensmeier 2005, Whitefield 2002).

Niches and ecological relationships. Species do not exist on their own in an ecosystem: rather, they tend to have interactions that are beneficial to both species (mutualism), beneficial to one species while not affecting the other (commensalism), or beneficial to one species while harming the other (parasitic) (Barbour et al. 1999). Edible forest garden design attempts to use these laws in species selection and placement: including nitrogen fixing plants to build the soil, utilizing companion plants, and completing a comprehensive ecosystem assessment as a component of developing a site development plan (Jacke and Toensmeier 2005).

Discerning an Edible Forest Garden from Permaculture. Permaculture is a system of design that envelops all aspects of living, while edible forest gardening focuses only on working with nature where we live to produce food (Mollison 1988). Edible forest gardens can be seen as one part of permaculture, where permaculture addresses a more holistic picture. I see forest gardens as a responsible, respectful method of interacting with the earth: producing food while designing our surroundings in alignment with nature. In my opinion, they have the potential to appeal to a wider audience: the ideas are less radical, they are not difficult to implement, and they are well grounded in ecological theory.

Relationship to Agroforestry. Agroforestry is defined by the International Council for Research in Agroforestry as "a collective name for land-use systems and technologies, where woody perennials (trees, shrubs, palms, bamboos, etc) are deliberately used on the same land management unit as agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components" (Lundgren 1982). The practice can be visualized in

systems as simple as grazing cattle underneath widely spaced trees. EFGs represent one approach in creating an agroforestry system, weighing heavily on ecological connections and the inclusion of a diverse array of species working together.

The foundation of edible forest garden design upon established ecological principles illustrates not only how edible forest gardens can be a productive, practical, and environmentally sound form of land management, but also how they can act as a useful demonstration area when installed on a college campus.

A Brief History of Edible Forest Gardens

Forest gardening has existed for thousands of years, in practice if not in name. In the following section I will outline (1) tropical "homegardens" and their influence on the current edible forest gardening movement, (2) European medieval gardens and their similarities to what we now call edible forest gardens, and (3) Native American land management.

Tropical Homegardens. Hoogenbugge and Fresco (1993) define what are known as 'homegarden systems' as "a small scale, supplementary food production system by and for household members that mimics the natural, multi-layered ecosystem." Tropical regions boast a great number of homegardens, particularly in Kerala, India and Java, Indonesia, as well as parts of Madagascar and Central America. Many residents cultivate homegardens: 20-36% in Java (Christianty et al. 1986) to upwards of 90% of households in areas of Sri Lanka (Verheij 1982). Homegardens are not a complete source of food and other provisions but provide a source of augmented income and a portion of nutritional requirements throughout multiple seasons (Hoogenbugge and Fresco 1993).

Edible forest gardens and homegardens share many similarities; in particular, minimal required maintenance and maximization of species diversity. The maintenance required for homegardens varies considerably from approximately an hour a week per hundred square meters up to about an hour a day (Hoogenbugge and Fresco 1993). Incredibly diverse, gardens in Java have been reported to contain up to 240 different species and subspecies per hectare (Bompard et al. 1980, Michon et al. 1983). Innately experimental, crops in homegardens are planted at a much higher density than in plantations or fields, and provide long-term and continuous production of food throughout the year (Hoogenbugge and Fresco 1993, Kumar and Nair 2004).

Edible forest garden pioneer Robert Hart was inspired by homegardens and introduced the idea and practice to his native England. While most literature on EFGs cites this as the basis for reintroduction, roots of EFGs also are evident in historical land management practices throughout temperate areas, including his native England.

Medieval Europe. Medieval landscapes in western Europe were heavily managed for useful products, both in immediate surroundings as well as the extended environs. While meat, fish, and grains provided primary sustenance for medieval peoples, kitchen gardens supplied essential complementary nutritional requirements (Harvey 1984, Pearson 1997). These kitchen gardens consisted of both annual and perennial plant species. Some plants mentioned in the literature on medieval European landscapes are also common in edible forest gardens (listed in Table 3.2). Hedges, or close set multi-species rows of bushes and small trees, typically designated areas of land ownership, and served as a source for coppice growth

Table 3.2 *Plants common to medieval gardens and edible forest gardens*	
Fruit trees	
Apple	*Malus pumila*
Apricot	*Prunus americana*
Pear	*Pyrus communis*
Plum	*Prunus domestica*
Medlar	*Prunus persica*
Quince	*Cydonia oblinga*
Mulberry	*Morus* spp.
Fig	*Ficus* spp.
Cherry	*Prunus* spp.
Vegetables, herbs, and greens	
Artichoke	*Cynara scolymus*
Asparagus	*Asparagus officinalis*
Chive	*Allium schoenoprasum*
Onion	*Allium cepa*
Garlic	*Allium sativum*
Skirret	*Sium sisarum*
Rose	*Rosa* spp.
Borage	*Borago officinalis*
Watercress	*Nasturtium officinale*
Fennel	*Foeniculum vulgare*
Lovage	*Levisticum officinale*
Mints	*Mentha* spp.
Sage	*Salvia officinalis*
Thyme	*Thymus officinalis*
Wood Sorrel	*Oxalis* spp.
Burdock	*Arcticum lappa*
Nut trees	
Chestnut	*Castanea* spp.
Walnut	*Juglans* spp.
Almond	*Prunus* spp.
Hazelnut	*Corylus* spp.

and timber as a well as a means to segregate livestock and provide wildlife habitat (Rackham 2002).

Wilder lands were consequently managed primarily for wood products and animal grazing. Many of the diverse native trees would coppice (sprout from the stump) or sucker (sprout from the root) when cut down, providing long, straight, and more useful shoots for basket and fence making; this was a common practice in woodland management (Rackham 2002). When cut at such frequency (every few years), the trees' longevity is magnified (Rackham 2002). In pastureland, trees were pollarded (cut to coppice stools approximately 10 feet off the ground) to protect them from animal graze while concurrently producing useful shoots (Rackham 2002). Fields, grasslands, and wet meadows were valuable resources for grazing cattle and for hay (Rackham 2002).

Indigenous Practices in North America. Prior to the infusion of European culture to North America, Native Americans blurred the line between gathering and agriculture

Photo 3.1 *South Puget Sound Prairie landscape*. Fire promotes the native and edible camas (*Camassia quamash*). Photo credit: Frederica Bowcutt.

by managing the land upon which they lived, through burning, harvesting, tilling, girdling, pruning, sowing, and tending (Abrams and Nowacki 2008, Anderson 2005). The landscape Europeans encountered upon arrival in the Americas was not pristine or untouched, but instead managed by cultural practices ingrained in collective myth, song, and dance resulting in cultural landscapes (Anderson 2005). Human influence as such is referred to as *anthropogenic forest* or *humanized forest* (Nabhan 2008). I suggest this historic land management regime, in the form of edible forest gardens, offers potential for solving some of today's sustainability challenges, as they recreate this interactive, human-ecosystem association.

Succession and disturbance are two primary concepts in edible forest gardening theory, and were two staples of indigenous land management. Most vegetation types in California are dependent on disturbance; fire adaptation in the flora predated

indigenous peoples and subsequently influenced land management practices (Anderson 2005). Anthropogenic environmental disturbance is considered to be the primary factor in keeping prairies and grasslands, berry shrubs, and fruit and nut trees, from returning to closed-canopy forest in eastern North America (Abrams and Nowacki 2008). Similarly, the Pacific Northwest bioregion, and the Puget Sound and Willamette Valley subregions in particular, host prairie ecosystems maintained by indigenous influence (Leopold and Boyd 1999, Norton 1979). Fire was regularly used to tend the landscape: burning decreases fuel levels, thereby reducing the risk of catastrophic fires. Also, low to moderate severity fires cycle nutrients back into the soil and reduce insect and pathogen problems (Certini 2005). Fire also modifies the forest structure, maintaining early to mid-seral stages which often bear many useful species (Leopold and Boyd 1999, Norton 1979, Storm and Shebitz 2006).

Though fire is not a common maintenance regime used in edible forest gardening, it does suggest scheduled disturbance. This is addressed through harvest and intentional succession. Historically, several characteristics of harvesting affect the surrounding ecosystem: the technology used, the season, the frequency and intensity, and long-term patterning (Anderson 2005). Selective harvest and transplanting can also lead to genetic modification over time (Anderson 2005). Harvesting methods can encourage seed dispersal through the intentional spilling of seeds during collection, as was often the case when collecting grain seeds. Tending plants can increase their value, whereas leaving them completely alone leads to a decline in ethnobotanical value. For example, hazelnuts, an important food source, were burned to produce more nuts, and to encourage long straight shoots, useful for basketry (Anderson 2005). Thus, EFGs have the potential to recognize bioregional ethnobotanic histories and create cultural learning opportunities.

Food Sustainability and Edible Forest Gardens

One of the most pressing sustainability challenges we currently face is developing sustainable food systems. I will not argue here that edible forest gardens can completely replace our global sustenance requirements, but demonstrate how they can serve as an alternative food production method and contribute to recreating our mental model of feeding the planet.

Food Security. Much food is currently produced in monocultures on large farms. On an international scale, this approach potential problems such as large-scale crop failure and reliance on long-distance transportation. Edible forest gardens possess greater resilience, are adapted to bioregional climates, and consist of diverse food bearing species.

Food Accessibility. In the United States, it is estimated that 22 to 30 million people are not able to acquire enough food to meet their nutritional needs (Poppendieck 1997). On private lands, fruit trees often produce more than a single family can consume, and extra fruits can be donated to food banks. Public areas can support these perennial, low-maintenance, resilient systems, with potential as an additional source of food for low-income people. EFGs could provide more accessible food if grown in public spaces.

Food Distribution. Urban agriculture and local food movements have arisen in response to the great distances that now are common for food to travel before being eaten. The term 'food miles' refers to the distance food travels from origin to consumption, acting as an indicator of energy requirements, and therefore contribution to greenhouse gas emissions (Pirog 2004). Several studies illuminate the significant distance between food origin and consumption: as illustrated in Table

Produce Type	Locally grown	Conventional Source Estimation
	WASD (miles)	WASD (miles)
Apples	61	1,726
Beans	65	1,313
Broccoli	20	1,846
Cabbage	50	719
Carrots	27	1,838
Corn, Sweet	20	1,426
Garlic	31	1,811
Lettuce	43	1,823
Onions	35	1,759
Peppers	44	1,589
Potatoes	75	1,155
Pumpkins	41	311
Spinach	36	1,815
Squash	52	1,277
Strawberries	56	1,830
Tomatoes	60	1,569
WASD - for all produce	56	1,494
Sum of all WASDs	716	25,301

Table 3.3 *A comparison of locally grown and conventionally sourced food miles within Iowa State.* WASD refers to Weighted Average Source Distance, and conveys a single distance based on information combining source location, point of sale, and food amount.

3.3, a study of 16 produce items in Iowa found the average distance traveled by the majority of the items to be 1,484 miles, compared to 56 miles for locally grown (in-state) produce (Pirog and Benjamin 2003). Similar studies in Chicago found that the average food miles traveled for fresh produce to arrive at the Chicago Terminal Market was 1,518 miles (Pirog et al. 2001), and in Maryland, the mean distance was 1,686 miles (Hora and Tick 2001). The percentage of food imported into the United States is greatest for vegetables and fruits in the off-season, peaking in the months of January, February and March at 600-700 million pounds (Putnam and Allshouse

2001). Imports have risen sharply: between 1977 and 1999, United States fruit imports have grown from 17.6% to 33.6% (Putnam and Allshouse 2001).

Poor food distribution structure leads to increased food loss. Thirty percent of food in the United States is thrown away each year: losses of cereals and grains are over 10%, losses of fruits, vegetables and tubers are often greater than 25%, and fish spoilage is estimated at 40% (Lundqvist et al. 2008, James 1986, FAO 1989, Hanley 1991). Increasing food production within and near urban areas decreases the distance it must be transported. Currently, over 700 million worldwide residents acquire food from small plots converted from vacant yards, and this practice is growing (FAO 2005). In Hanoi, Vietnam, 80% of fresh vegetables and 50% of poultry and fish are grown in farms within or immediately adjacent to the city (de Bon 2006); in Caracas, Venezuela, microgardens in the barrios totaling 8,000 square meters produce foods for residents (Bradley and Marulanda 2007). In temperate climates, 44% of residents in Vancouver, Canada, report producing some of their own produce (City Farmer 2002). Urban agriculture and near-urban farms have the potential to supply a great amount of food to urban residents, with edible forest gardens arising as one low-maintenance solution. College campuses often occupy significant acreage, even in urban areas. The addition of edible forest gardens would offer food to an increasing number of people while demonstrating the potential of urban spaces in addressing food sustainability.

Food Diversity. Industrial scale agriculture has had a significant negative effect on biological diversity, resulting in loss of both species diversity and genetic resources. For example, only 20% of Mexico's maize varieties, 10% of China's wheat varieties, and 15-20% of the USA's varieties of apple, cabbage, field maize, pea, and tomato are still available today (Groombridge and Jenkins 2002). Wild crop

relatives may contain important genes that can contribute to disease resistance and climate change, but are in danger of being lost themselves as agriculture becomes increasingly industrialized (Nellemann et al. 2009). A major tenet of edible forest garden design is its emphasis on establishing a broad range of edible species in the garden area, particularly an array of both native and hybridized cultivar and heirloom species.

Land Use. Land degradation due to improper agricultural practices and deforestation affects approximately 2 billion hectares of the world's agricultural land, resulting in net-loss of productivity due to soil salinization, nutrient depletion, and erosion (Pinstrup-Andersen and Pandya-Lorch 1998). Conventional agriculture has been a major contributor to loss of habitat for 38% of federally listed endangered species (1,207 total) (Wilcove et al. 1998). Increasing urbanization also decreases the amount of arable land available for agriculture (Nellemann et al. 2009) Edible forest gardens require little space, and can develop food-producing systems for residents on as little as a tenth of an acre of land – a standard urban lot. Learning to cooperate with our ecosystems in this manner is important as we contend with poor land use practices that are degrading them.

Climate Change. In 1979, Cox and Atkins (1979) found it took 10 fossil fuel calories to produce a single food calorie, a ratio that parallels our growing reliance on fertilizers to increase productivity. Large-scale agricultural systems require fuel, natural gas for fertilizer production, and irrigation – all of which contribute to climate change. Additionally, the food distribution issues described above contribute to carbon emissions. Anthropogenic climate change is an increasing concern for a host of social justice and environmental reasons. In contrast, edible forest gardens reduce food miles, sequester carbon, and require no petrochemical inputs.

Though food sustainability is a multifaceted and complicated issue, edible forest gardens address many of the major concerns, and also offer a starting point for discussion and investigation of developing a sustainable system.

Teaching with Gardens

Because of the interconnectedness of food within culture, science, and our long-term species survivability, getting students connected with food issues through programs associated with a food forest garden in the housing area will impact student understanding of sustainability. Several studies discuss effects of gardens in an educational context, though there are few examples from higher education (Civil 2007, Graham et al. 2005, Graham and Zidenberg-Cherr 2005, Higgs and McMillan 2006, Mkinne and Halfacre 2008, Morgan et al. 2009, Ozer 2007, VandDerZanden and Cook 1999). Teachers were found to use gardens to facilitate teaching with core subjects: science, math, and language arts (Civil 2007, Graham and Zidenberg-Cherr 2005). Nutrition is also demonstrated to have been taught effectively through the inclusion of on-campus gardens (Graham and Zidenberg-Cherr 2005, McAleese and Rankin 2007). Gardens were seen as models for teaching sustainability at the high school level in a case study of secondary schools (Higgs and McMillan 2006). Because they align with food systems as well as ecological systems, Capra (1998) identifies school gardens as beneficial for individuals and the community, teaching ecological literacy and sustainability. At the higher education level, VanDerZanden and Cook (1999) emphasize the various uses of a teaching garden at Oregon State University, both as it augments coursework and contributes to student feelings of ownership. Similarly, teaching gardens at the University of Tennessee support several programs and offer opportunities for plant identification, photography, and ethnobotanical use, garden design and maintenance, cataloging, and nature writing (Hamilton 1999).

Many other colleges and universities support and use teaching gardens, often maintaining curricular connections with agriculture and food production (including kitchen gardens), restoration and habitat provision, and botany and plant science. Fairhaven College at Western Washington University hosts four student-run garden projects including community gardens, a market garden, an herb garden, and a forest garden. The forest garden includes fruit trees and berry bushes. The extensive University of Washington Botanical Gardens envisions its work as "an international hub for plant science, information, teaching, and stewardship, …promoting an educated, inspired, and engaged society dedicated to sustainable ecosystem management" (University of Washington Botanical Gardens website, accessed July 20, 2009). Beck et al. (2002) found that when paired with informational signage, web and/or print materials, and supplemented with workshops, demonstration gardens have significant potential to change public perception about alternative landscaping.

The literature presented above suggests that edible forest gardens provide a sustainable approach to landscaping, and can be a useful tool for education. Edible forest gardens provide food and promote healthy ecosystem practices. This style of land management has been practiced around the world throughout history. Gardens have also been used to supplement coursework at the K-12 and higher education levels, with promising results. The findings presented in this thesis will build upon this foundation to demonstrate how edible forest gardens are valuable in developing sustainability education and operations at Evergreen.

Chapter IV | Research Methodology: A Mixed-Methods Approach

This chapter will provide details on my research approach in addressing whether edible forest gardens can facilitate sustainability (a) through teaching and learning with students in and out of the classroom, and (b) for the campus community as a component of a campus sustainability plan. In considering the first part of the question, I engaged a group of 48 students enrolled in a 16-credit program about food systems and culture in an edible forest gardening workshop, using before and after surveys, voluntary interviews, participant observation, and guided reflective writing to collect data. Pre- and post-survey questions are included in Appendix I and II, respectively. To gather data addressing the second part of the question, I engaged in interviews and participant observation with key members of the campus sustainability community, relevant community groups, student residents, and interns, and volunteers (a total of 20 people). Typical interview questions are included in Appendix III. The research was conducted from January to June 2009, at The Evergreen State College. I worked with three student interns to develop the project, each of whom was assigned specific tasks based on their backgrounds and interests. A full project description is included in Appendix IV.

Role as Complete-Member Researcher

My employment responsibilities as a Graduate Sustainability Fellow and as project coordinator, lead me to define my role in this research as equivalent to Adler and Adler's (1987) designation, "complete-member researcher." Though fully involved in campus sustainability issues due to my position, throughout the course of my research I carefully stepped back from my immersion to reflect upon the data. Because of my role on campus, I was able to be present in a number of situations,

such as Sustainability Council meetings, to observe how sustainability is considered on the campus. As the project coordinator, I received unanticipated feedback from students, faculty, and staff in regards to their perception of the project, which proved valuable in assessing how far-reaching the project was, and about its effects on those who were not immediately involved in the process, installation, or classroom experience.

Case Study Research

My research design employs a case study framework of installing edible forest gardens in residential housing at The Evergreen State College. It follows what Stake (2000) defines as an *instrumental case study*, which focuses upon a case to make inferences about a topic with a larger scope than the case itself. Because of the very specific details of Evergreen's institutional and academic structure, the lines are somewhat blurred between its designation as an instrumental case study, and an *intrinsic case study* (Stake 2000), which looks at a case in particular, in and of itself. This case, though situated at Evergreen, does attempt to look beyond the impacts only at Evergreen, and to generalize how edible forest gardens can educate about sustainability on other campuses, and potentially outside of the academic world.

Based in Olympia, the capital of Washington State, The Evergreen State College is a public school with an enrollment of approximately 4,000 students each year. A progressive college using narrative evaluations instead of grades to document student work and favoring full-time, interdisciplinary coursework over single classes, a case study on this campus sheds insight into what alternative education models (and the students and faculty drawn to this system) can support in terms of sustainability. Despite its alternative pedagogy, the state-run campus is still bureaucratic, which was evident at several junctions within the study. Therefore, this

case presents a campus and its community members who are at one point along a continuum moving towards sustainability, and can raise awareness beyond the case itself.

Transcribing and Coding Qualitative Data

Upon completing interviews with subjects, I immediately transcribed interview data using a word processing program. Doing this shortly afterwards allowed me to capture thoughts I was having in the moment. I used the "Comments" function as I was transcribing, to make annotations, and in the process of coding. Upon transcription and subsequent reviews of the texts, I identified categories, and themes that fit within them. As I continued to refine my coding categories, I began to recognize the more dominant and universal themes. I also coded open-ended survey questions. Where it was applicable, I identified the most common words or phrases, and conducted a count of how many students brought up a concept in these open-ended questions.

Limitations

This project does have several limitations. Many of them are due to the short temporal nature of the thesis, as compared to the time it tales to establish and use a perennial garden. The project timeline was primarily a limitation in assessing long-term project impacts on student learning about sustainability and local food issues. Research was conducted over a 6-month period, with three months allocated to classroom learning assessment. Since the garden was being established, it was not possible to assess students' long-term development of understanding about sustainability or food issues. Instead, I had to make a quick assessment of how this could fit in with a class in this short period of time. Rather than focus on how an established project of this sort can enhance learning about sustainability, the study

narrows in on how the installation process could act as a teaching tool, both for volunteers as well as within a classroom setting. There is room for future study of how this garden space may perform in the long term.

In regards to the breadth of the study, I was limited by working with only one course with a population of 48 students. It would have been more advantageous to work with multiple programs in order to further demonstrate the variety of curricular connections that can be made with edible forest gardens. Therefore, the results of the surveys include only the perspectives of students who were self-selected to engage in a program about food and sustainability. This limitation is due, in part, to the challenge of collaborating with multiple faculty members. While a number of faculty expressed interest, the lack of time on both ends led to the full inclusion of this one group of students.

There are limitations in the garden due to site conditions: it is shady and moist, and it lacks exceptional soils. For this reason, I was limited in the scope of species that are typically included in an idealized edible forest garden. Though presenting logistical challenges, this approach demonstrates how to contend with difficult site conditions.

Chapter V | Findings: Student Learning and Campus Community Perspectives

In the following section I present and analyze my data. First I will present the data collected from working with the class program, to address whether edible forest gardens facilitate sustainability through teaching and learning with students both in and out of the classroom. Next, I will present interview data that speak to the contribution of edible forest gardens facilitating sustainability for the campus community as a component of a campus sustainability plan. Then I will draw connections that support the assertion that edible forest gardens are an important component of a campus sustainability plan, and that they contribute to teaching and learning in and out of the classroom.

Photo 5.1 *Before installation: looking southwest with athletic fields in the background.* Photo credit: author.

Edible Forest Gardens Educating about Sustainability

To analyze effects of learning about edible forest gardening within the classroom, I engaged students from the full-time, 16-credit program, Food, Place, and Culture (course description included in Appendix VI). Forty-five students filled out a pre-survey on their first day of class. During the second week of the term, I gave a presentation covering elements of edible forest gardening and its relationship to ecological theory, history and food sustainability. Immediately afterwards, students participated in an installation workshop in which they planted primarily dormant, sometimes bareroot, edible perennial species in a predetermined area on the campus. The proposal to the Campus Land Use Committee and the complete project description are included in Appendix IV and V, respectively; an outline of the presentation and workshop are located in Appendix VII. Thirty students submitted guided reflections upon completing the workshop. Six weeks later, the class

Photo 5.2 *Morning of installation: plants placed, multiple piles of wood mulch ready to be spread***.** Looking east from west edge of site. Photo credit: author.

Photo 5.3 *Students engaging together at the workshop*. Photo credit: Abigail Marshall

returned to the site and observed the garden, and I taught them about plant family relationships and the functions of specific plants. Additionally, this provided them the opportunity to see the plants once they had leafed-out and grown. Thirty-one students responded to post-survey questions. I divided the data into (a) the effects of the forest gardening workshop in combination with other classroom activities, and (b) direct impacts of the forest gardening lecture and workshops. First I will present and discuss the findings of sustainability education within the classroom.

Sustainability Education Using Edible Forest Gardens in the Classroom

In responses to pre- and post-surveys, students indicated an increase in their knowledge about sustainability concepts, food issues, and forest gardening as a result of both related course work and the edible forest gardening workshop. This is shown in their self-assessment of knowledge of the above concepts, their recognition of changes in food purchasing patterns, and in written responses demonstrating their attitudes towards local/organic food and gardening.

Students, on average, began the quarter with some baseline understanding of sustainability concepts (4.1 ± .23 on a scale of 1-7) and food issues (4.0 ± .2), which increased throughout the term (sustainability to 5.0 ± .25, food issues to 5.3 ± .21). Students' knowledge of forest gardens changed more dramatically (from 2.0 ± .19 on a scale of 1-7, to 4.5 ± .28), likely due to the relative unfamiliarity many students had of the topic beforehand.

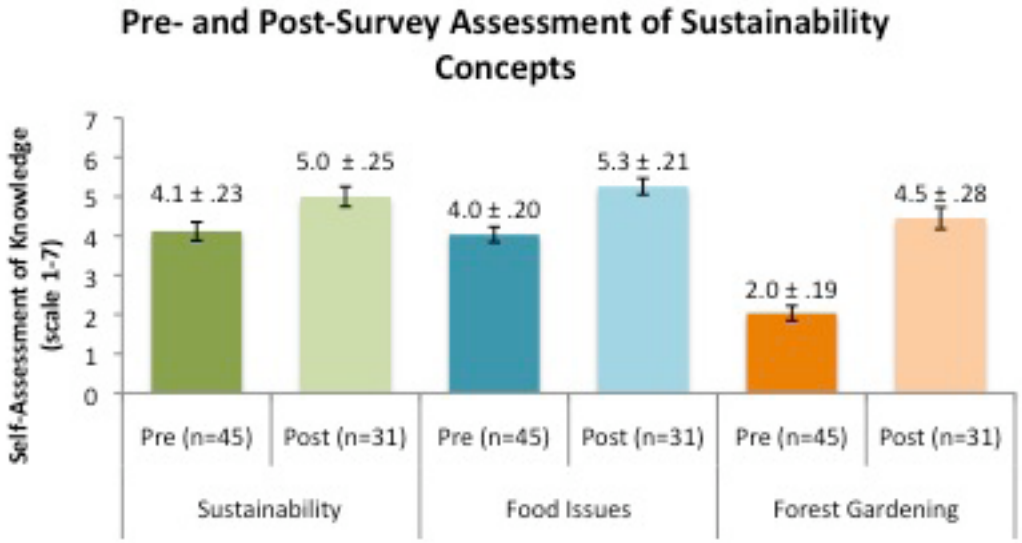
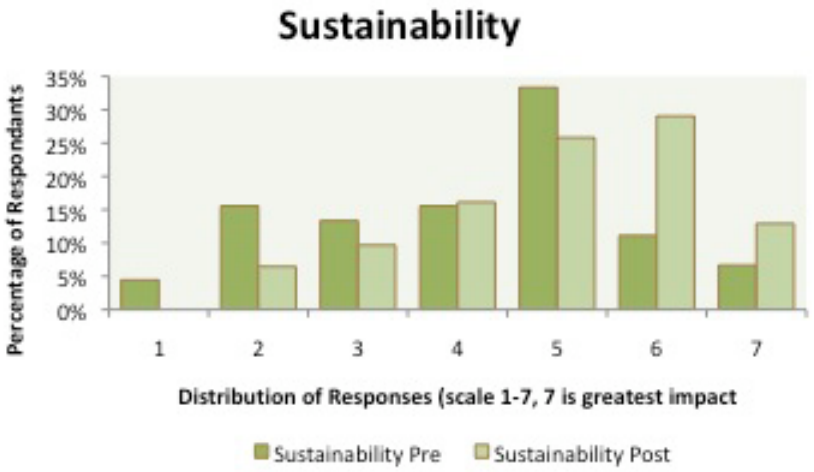
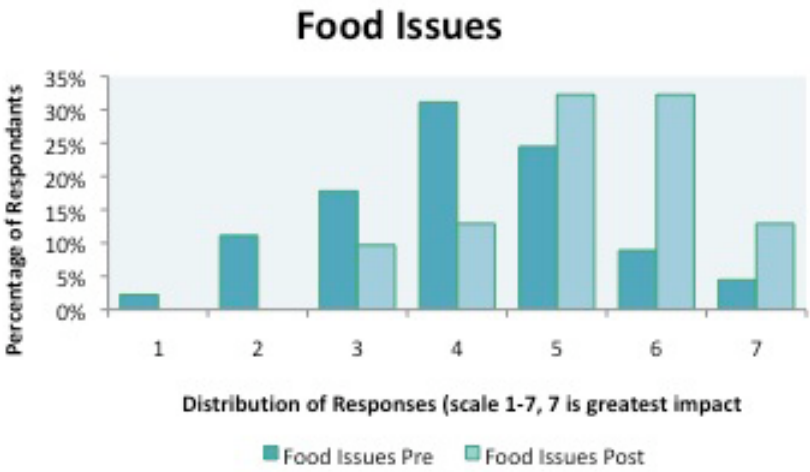


Figure 5.1 *Pre- and post survey assessment of sustainability concepts*

Looking at the distribution of students' responses is even more revealing. Whereas few students claimed to know a great deal (selecting a 6 or 7) about sustainability (18%) or food issues (13%) in the pre-survey, almost half of students in the class selected a 6 or 7 in regards to their knowledge in these areas (sustainability 42%, food issues 45%) in the post-survey. In the pre-survey, 71% of students indicated they had very little to no knowledge about forest gardening (selecting a 1 or 2), while in the post-survey, no students made this claim.





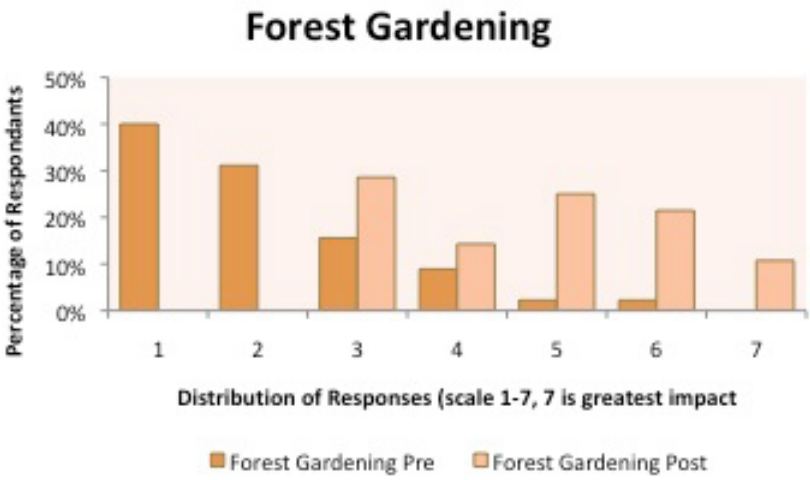


Figure 5.2 *Distribution of before and after student self-assessment of knowledge about sustainability, food issues, and forest gardening.*

Change in purchasing and eating behavior is another indication of awareness of food issues, though change of habits may materialize long after awareness of the issue (Angehrn 2004). An unanticipated result was that over half (55%) of the students indicated they had changed their eating and food purchasing habits since the beginning of the class. With the exception of one student crediting financial change and two students citing that they moved as reasons for their change, all other motives behind the change were related to increased awareness about food issues, choosing more local and/or organic foods, and education due to their coursework.

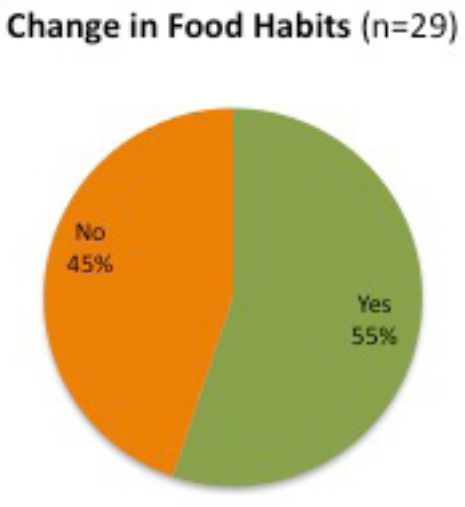


Figure 5.3 *Change in food purchasing habits.*

When asked about their local and organic purchasing habits, students did not demonstrate a great change in organic purchasing habits. However, as shown in figures 5.4 and 5.5, respondents who declared that 50%+ of their food purchases were locally grown increased from 8% in the pre-survey to 26% in the post-survey.

Direct impacts of Forest Gardening Workshops on Student Learning

To determine the role of the Edible Forest Gardening workshops on student learning within the larger context of the class, students were asked to indicate to what extent these workshops enhanced their learning of sustainability concepts, food issues, and growing food. Additionally, Evergreen's five learning foci were used to assess how students' knowledge developed in these capacities. The following section describes

Figure 5.4
Change in Local Food Purchasing Habits.

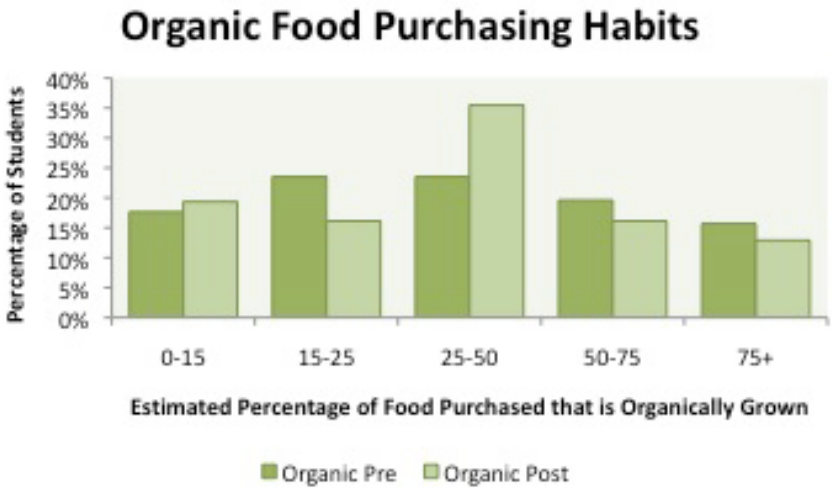


Figure 5.5
Change in Organic Food Purchasing Habits.

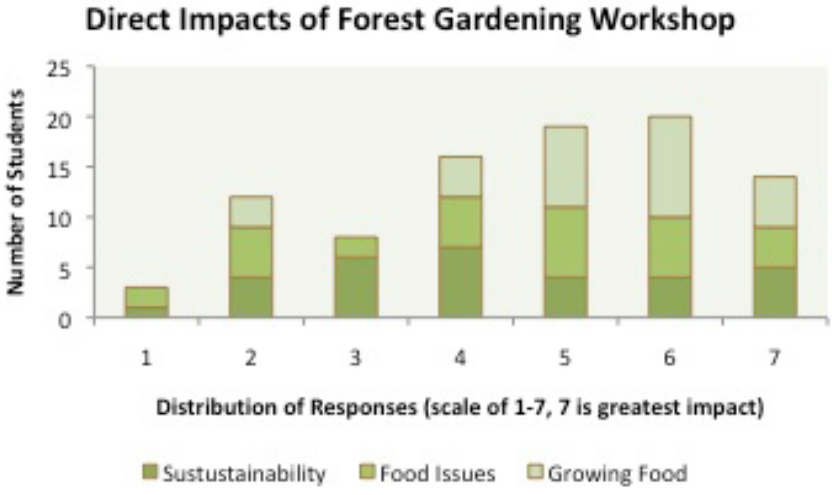


Figure 5.6
Direct Impacts of Forest Gardening Workshop. Students' assessment of forest gardening workshops' direct impacts on their understanding of a) sustainability concepts, b) food issues, and c) growing food.

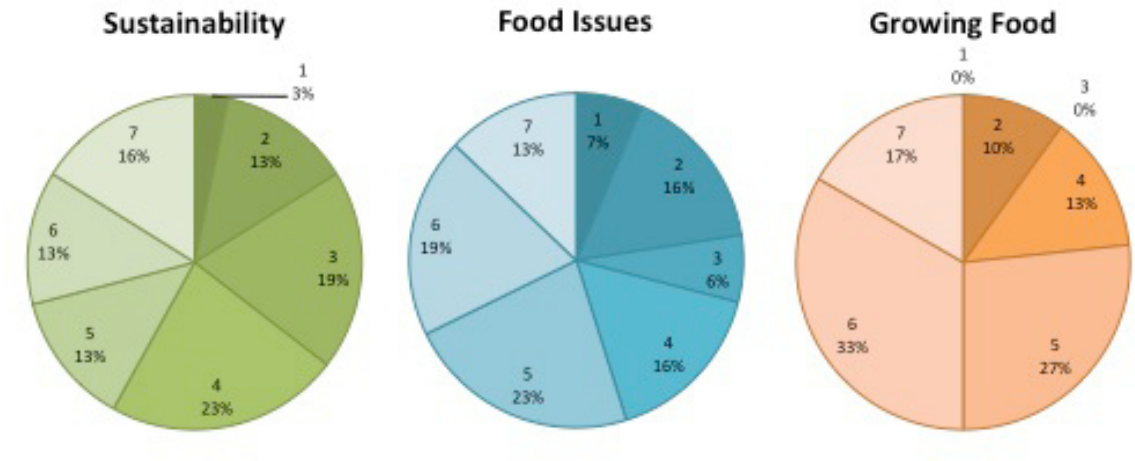


Figure 5.7 *Direct impacts of forest gardening on students' knowledge about sustainability, food issues, and growing food.* The pie graphs show distribution of student answers on a scale of 1-7, with 7 indicating the greatest impacts.

the direct impacts of the workshops on both the specific concepts mentioned above and the types of learning.

Figures 5.6 and 5.7 demonstrate how students perceived their experience with the forest gardening workshops to have directly impacted their learning about sustainability concepts, food issues, and growing food. The strongest impact of the workshops was in regards to growing food. The pie graphs individually demonstrate the impacts of the forest garden workshops on students' knowledge of the above issues. The workshops had less of an impact on sustainability than on food issues, and had the greatest impact on students' understanding of growing food. Half of students (50%) indicated the workshops very significantly affected their understanding of growing food (selecting a 6 or 7 on a scale of 1-7), and approximately one-third (32% and 29%) of students indicated a similar influence on their knowledge of food issues and sustainability, respectively.

The Evergreen State College: Five Learning Foci
Interdisciplinary Study
Students learn to pull together ideas and concepts from many subject areas, which enables them to tackle real-world issues in all their complexity.
Collaborative Learning
Students develop knowledge and skills through shared learning, rather than learning in isolation and in competition with others.
Learning Across Significant Differences
Students learn to recognize, respect and bridge differences - critical skills in an increasingly diverse world.
Personal Engagement
Students develop their capacities to judge, speak and act on the basis of their own reasoned beliefs.
Linking Theory with Practical Applications
Students understand abstract theories by applying them to projects and activities and by putting them into practice in real-world situations.

Table 5.1 *TESC 5 Learning Foci*

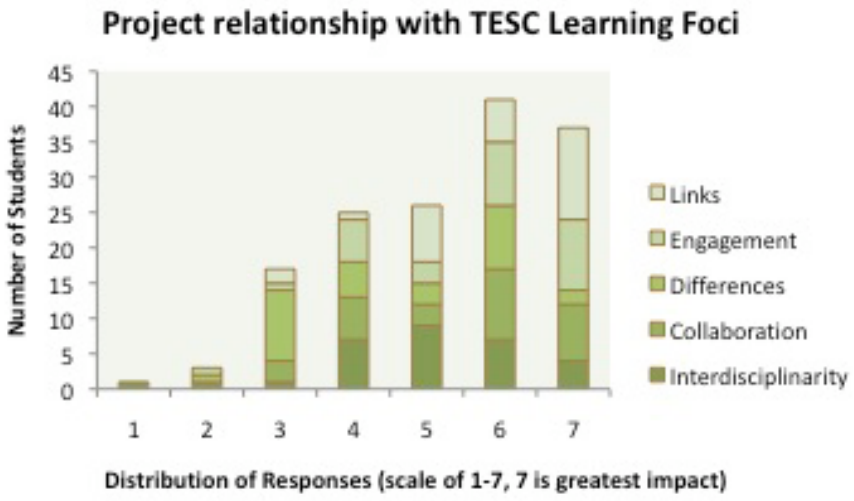


Figure 5.8 *Project relationship with TESC learning foci*

Figure 5.9 *Areas of learning.* Student reflections indicated their learning was divided primarily into theoretical learning about forest ecology and forest gardens, and practical learning on garden installation and planting

Students perceived their learning about edible forest gardening to relate to the five learning foci at Evergreen, as illustrated in figure 5.8. There are strong links between each of the five learning foci and the edible forest gardening workshops. Very few students (10% or less) thought that the edible forest gardening workshops did not address Evergreen's learning foci in all areas except "Learning Across Significant Differences." Most students significantly (choosing a 5 or higher) saw the workshops as impacting: interdisciplinary study (65%), collaborative learning (68%), personal engagement (71%), and most notably, linking theory with practice (87%).

When asked how the workshops augmented the learning done within the context of the class, a number of themes emerged. Students most appreciated that the workshops were hands-on, and were a tactile example of the learning happening within the classroom. They also indicated, to a lesser degree, that it helped them to understand plants more, that it was an enjoyable educational experience, and that they appreciated the on-campus opportunity to take action.

Student Reflections on the Edible Forest Gardening Workshop

In addition to pre- and post-surveys, 20 students filled out a reflections worksheet upon completion of the first workshop. This was in an effort to capture the immediate impacts of their learning, and how they thought, at that point, they could integrate these concepts into future learning.

Students' responses indicated that their learning was divided into theory about edible forest gardening and forest ecology, and hands-on learning about planting and the process of installing a garden. Forest ecology concepts (35% of responses) they noted included: succession, nitrogen fixation by plants, plant diversity, and vertical layering. There were a great variety of edible forest gardening concepts (60%) that

they took away with them. Their learning about planting (40%) indicated that they were learning how to plant in general, or techniques that they did not know before (how to determine the size/depth of the hole). In regards to a garden installation process (45%), students were fascinated about the use of cardboard and mulch to transform a landscape. Some selected excerpts:

> Learning about edible forest gardens was fascinating. I would really like to continue learning about it. It is such a great way of using your backyard as a garden. The cardboard-mulch was also really intriguing.

> I learned about how cool it is that plants can grow in layers and also that alders are nitrogen fixers.

Because the workshop was in two parts, the first consisting of an indoor lecture on the background of what we would be doing, followed by the workshop, it makes sense that both parts of the workshop impacted their learning. Many students indicated that the experience inspired them to learn more.

Surveyed students indicated that the workshop could be incorporated into their future perspectives on food, place, and culture (the topic of their class program) in a number of ways. Some excerpts:

> Getting a hands-on experience with planting food is such an awesome, visceral feeling and that will definitely affect my thoughts on food.

> Its amazing to me how fun and fairly simple it can be to plan and plant an edible forest garden and that it's an excellent alternative source of food.

> I'm more inspired to grow plants and get involved in this community. This is good info.

They primarily articulated a better understanding of plants, both edible and native, an interest in creating their own space using this model in the future, and an empowered perspective about growing food.

Photo 5.4 *Above: Class program working during garden installation.* Photo credit: Abigail Marshall.

Photo 5.5 *Below: Students during workshop.* Photo credit Abigail Marshall.

In relationship to campus sustainability, the overriding theme was that students have a great concern about vandalism and hope that the space is respected.

> I think it's a great step towards teaching about sustainability through a hands-on, beautiful garden. It's something unique that people can get excited about.

> I lived in "I Dorm" in 2004 when it was the first sustainability house but we didn't have the capabilities to do anything. So I am so happy that things are in motion now, and I hope the Evergreen community will be respectful.

Students saw the space as a food option, an example of sustainability, and a learning opportunity.

Independent Study

Three students conducted independent study projects on edible forest gardens during the process of planning the installation. The learning they demonstrated reflected deeper understanding of the subject matter, and the potential for edible forest gardens to serve as a teaching tool.

Abigail Marshall worked with me during the site design, and completed significant work on site analysis and plant selection. Combining grounded theory with the practice of taking observations, examining soils, planning the garden space, doing outreach, installing the garden, and then caring for the garden greatly impacted Abi, who worked most closely with me on the project. She attributes a lot of this to the hands-on experience, as well as working independently. She described being challenged, more than merely academically, but also in growing as a lifelong-learner:

> But then, in not having a structured time for when I was supposed to be doing it and when I wasn't, it was easy to make this project connect to other things I was doing in my life, which was the Environmental Resource Center[1], and it made the ties between this project and

[1] The Environmental Resource Center is a student environmental advocacy organization at Evergreen.

> everything else all that much more apparent. The idea of connecting a community, and being connected to your food source: those are things that - you don't have a set block of time that you're going to do those things, they're just things that you live.

While she was initially interested in the hands-on aspect of the work, the background study that was required through readings and research facilitated her investigative skills as well as developing her understanding of botany, ecology, and food systems. She recalls:

> I didn't even really know what an edible forest garden was before I started this project, and I started reading about it, and the first clue that I got, I think, was in opening up the textbook and they didn't even really say the word "plant" for the first hundred pages. It was 100% ideology behind it. … I started reading more and realized that it was so much more than just what you can see and what you're physically doing.

At the beginning of the quarter she had a strong interest in but demonstrated little understanding of plant family relationships; at the end of the project she was reciting the genera of the plants installed, their site requirements, and edible/ medicinal properties.

Sarah Betcher involved herself in the soils analysis and in creating an outline for a walking tour. She managed communication with the soils lab, collected samples, and interpreted results. Rebecca Swain-Sugarman undertook a documentary film project in an effort to involve herself in the edible forest garden project. Enrolled in a media-focused full-time program, she concentrated her independent film project on the edible forest garden. She filmed students during the volunteer installation day seeking connections between community, edible forest gardens, sustainability, and volunteer work. Her short documentary (available at www.evergreen.edu/rad/sustainability/edibleforestgarden.htm) sharpened her media skills while further developing Evergreen's sustainability message. At a film screening highlighting her class' work, Rebecca's documentary

generated excitement, a great amount of applause, and many questions. Some students who had participated in the installation were in attendance, and her work further initiated discussion and debate about gardening, community and place, food, and campus sustainability. Her teacher expressed interest in submitting a copy to the campus library. In addition to reflecting Rebecca's good work and technical skill development in the film medium, this example demonstrates how the process of installing edible forest gardens can communicate a sustainability message in both theory and practice.

Edible forest gardening workshops effectively educated students about sustainability, food issues, and edible forest gardening in this study. Additionally, students asserted they had made changes in food purchasing habits. The EFG component itself had direct impacts on student learning about sustainability, food issues, and growing food, and maintained strong links with four of Evergreen's five learning foci. Student reflections indicated they had learned both theory and practical knowledge about growing plants, and embodied knowledge that they would like to carry with them.

Edible Forest Gardens Facilitating Campus Sustainability

The second part of my research inquiry asks whether edible forest gardens can facilitate sustainability on a college campus. I used semi-structured interviews to collect qualitative data from students, student group coordinators, community members involved with edible forest gardens, faculty, and members of the campus who maintain an interest or due to their position on the campus have an effect on sustainability decisions. I focused on six categories:

1) What are considered important campus sustainability goals?

Figure 5.10 *Overview of interview responses by theme*		
Category	**Theme**	**% of Respondents**
Campus Sustainability Goals (n=10)	Include sustainability in curriculum	20
	Effectively communicate sustainability concepts	60
	Foster a sustainability ethic	60
	Realize changes in campus operations	50
	Encourage alternative transportation	10
	Focus on sustainable food	10
Important Elements for Projects Bridging Operations and Student Work (n=10)	Collaboration and compromise	50
	Administrative support of student work	50
	Cultivate positive student-staff relationships	40
	Development of a clear plan	20
	Maintain an openness for experimentation	20
Challanges (n=11)	Ensuring long-term continuity	100
	Student project follow through	50
	Potential for garden to be unsuccessful	40
Benefits of Gardens on a College Campus (n=14)	Supports teaching and learning	60
	Establishes opportunity for long-term study	53
	Fosters student feeling of ownership	47
	Communicates concept of place	60
	Illustrates low maintenance approach	33
	Offers a model for success	20
Sustainability Issues addressed by edible forest gardens (n=14)	Land use	79
	Ecology	79
	Food systems	64
	Bioregional concepts	64
	Ethnobotany	43
How forest gardens can connect to teaching and learning (n=15)	Aid in curriculum integration	80
	Provide experiential and service learning opportunity	80
	Help students link theory to practice	47
	Support students' personal growth and development	47

2) What are required elements for successful projects bridging campus operations and student work?
3) What are the challenges of installing an edible forest garden on a college campus?
4) What are benefits of gardens on campuses?
5) What sustainability issues do edible forest gardens address?
6) How do edible forest gardens connect to a campus' primary focus of teaching and learning?

Campus Sustainability Priorities and Goals

In order to assess whether edible forest gardens are important to a campus sustainability plan, I assessed the campus' established sustainability priorities and goals. Interview respondents most strongly referred to *communication and messaging about sustainability* (60%), and *establishing a sustainability ethic* (60%) as campus priorities. Communication and messaging refers to broadcasting sustainability concepts and information to all campus community members. As Director of Residential and Dining Services and Sustainability Council member Sharon Goodman states, "I think that if you just keep messaging, people will begin to question before they do things. And you want to get people to think about, well, 'what questions should I be asking before I do that'." Communication and messaging were closely linked to establishing a sustainability ethic. Sharon continues, "Its about changing the culture so people have the consciousness to think about [sustainability] and social justice issues – so its not just *cool* to carry your mug or its not just cool to be sustainable."

Strengthening sustainability within the curriculum was only mentioned by 20% of respondents as a priority in campus sustainability, and I attribute this to the

lack of faculty representatives in my interview pool. As College President Les Purce summarizes, “The first thing that’s important, if you’re going to sustain an intensity, and a commitment to issues of climate change and sustainability–it has to be built into the educational curriculum.” An interim report by the Sustainability Task Force in 2006 echoes Purce’s comment, naming “Establish a curricular pathway in sustainability” and “Increase opportunities for a practical education in sustainability” as two of nine key strategies in leading towards a sustainable campus future. Other goals and priorities were related to developing a sustainable infrastructure with campus grounds and buildings (50%), transportation (10%) and food (10%).

Required Elements for Projects Bridging Operations and Student Work

The process of garden installation and establishing long-term care for a perennial garden space raised many questions about how to best collaborate on campus projects that span students and staff. Primarily a student-initiated and coordinated project, the site would have to be adopted by permanent staff in order for the garden to persist after current students have moved on. A college or university’s educational mission can sometimes impose a non-traditional context for staff who are central in its operations, which provides unique opportunities and challenges in developing sustainable practices.

Half (50%) of the interviewees saw a strong need for student and staff *collaboration and compromise*. Director of Facilities, Paul Smith, describes how this has arisen in his Facilities department in the past in both successful and unsuccessful partnerships:

> We've gotten a couple of students on Independent Learning Contracts that have melded very easily with what we were working on, so they were able to take their time and talent and make it easier for us to get the work done. And that's not always the case because the students have their vision of what they want to do and oftentimes, its not diametrically opposed, but its not one of those things that we were moving along doing, and they don't want to change their idea. If we could get them to look at some of the things we have going and to see potentially yes, what do you need from the student, what do you need from me and get that partnership, it would probably be beneficial to us all.

When students can adjust their visions to address the direct needs of the campus, it is easier for college staff to develop a working relationship that provides more resources and further supports the student project.

The acquisition of appropriate *resources* for students to achieve sustainability projects on campus was also a dominant theme that arose for 50% of respondents. From the administrative perspective, Les Purce notes, "We try to get out of their way in terms of giving them access to the best equipment and ways to think about it; I think that's what you do." A lack of support from the administrative side can be difficult for student coordinators, as Sierra Wagner describes when her request to build a toolshed for a similar garden on campus was not approved, "I felt like it was so defeating, and so against the purpose of that school and against the purpose of that program. So that was a big challenge." Access to resources, whether it is money, information, or equipment, contributes to the success of a campus student project.

Other resonating themes included the *development of positive student staff relationships* (40%), and *creating a well-laid out plan* (20%). Allowing *experimentation* was echoed as an important factor to consider in supporting student projects (20%), interestingly, by both administrative respondents from

Residential and Dining Services. Assistant Director of Residential and Dining Services in Charge of Facilities, Mark Lacina explains:

> As I continued to work here, I realized that, we're an education center, we're supposed to be out front, we're not supposed to be following, we're supposed to be leading, we're supposed to be experimenting and trying things: things that may not work. Its okay if they may not work here, whereas in the small business world, if they don't work, it could mean the end of a company. This is the place where this experimentation should go on.

I attribute this greater embrace of an experimental attitude in the Residential and Dining Services department to its heavy reliance on student workers, as it is a largely student-run establishment.

Challenges

To develop a successful model of an edible forest garden on a college campus, it is good to have an idea of the most prevalent challenges one might encounter. Creating *continuity* for a long-term project in a transitory student environment was overwhelmingly (100%) noted as the largest challenge to consider. Because students are so transitory, and the curriculum at Evergreen changes yearly, it is a challenge to ensure the future student body will retain a strong interest in the project. Incorporating the garden into an ongoing program can help to combat this. "Well, I think the most important thing would be if you could talk to faculty as including this on a scheduled program," faculty member Martha Rosemeyer suggests. The staff turnover at Residential and Dining Services Facilities also complicates the establishment of continuity, as student grounds lead Sam Lanz states: "I'll be here a couple more years. I might not be working for Housing. If nobody steps up to take on that responsibility, projects just fizzle out." Defining the edible forest garden as a priority for the Grounds workers, and providing them with resources for proper maintenance, can help to minimize this problem.

Also noted was the potential problem of *lack of student project follow* through (50%). This came up when subjects considered the future of the forest garden as well as in describing experiences with past student projects. Academics and extracurricular activities compete for student attention. As Goodman remarks, "I think the problem is that they get so wrapped into their academics that they have to pick and choose what they can do. They might like that there's a garden there, and they have other priorities. If they have to do it for class, then they'll do it." However, even when student-initiated and maintained projects are a part of an academic program or an independent learning contract, they can run into problems. Paul Smith observes, "Once they're finished with a program, they don't have any interest." He continues, mentioning a few exceptions: "We *have* had a couple students who, even after they were finished with the program, they continued with it. In fact, one of the students graduated and was back in the fall to help. That, to me, is what it takes." While this expectation may be extreme, I would assert that Smith's main point is that a student should have the proper advising to complete a project within the scope of the class program. When their work affects others in the campus community, they should have a certain level of maturity and respect so as not to leave the burden upon permanent staff to adopt on top of their existing duties.

Another challenge arising as a theme is the potential for the *garden to be unsuccessful* (40%). Contributing factors could include: high mortality rates, bad drainage, vandalism, lack of proper maintenance, and improper planting procedures leading to plant mortality due to high variability in volunteers' understanding of planting. Despite this being perceived as a challenge by some, it is also important to recognize the instructional value of an unsuccessful project. The fear of failure should not become too cumbersome to student creativity and drive. Adequate

guidance from instructors helps students to further their education and develop themselves whether the project ultimately fails or succeeds.

Benefits of Gardens on a College Campus

Though overcoming the challenges stated above requires thought and planning, the resulting benefits are likely to outweigh them. Many (60%) respondents voiced *teaching and learning* as a benefit of installing an edible forest garden on a college campus. While the value of curricular integration was noted and will be expanded upon below in the section about connecting gardens to teaching and learning, the garden sited in campus housing adds to its capability to reach a broader range of students. Mark Lacina reflects:

> They're going to learn from it, and it's the whole idea of the interconnected educational approach that I think we have in RAD, and that is: you learn by studying, but you also learn by doing, and the connection of the two. You learn by living, also; they're not these separate things: you go into the classroom, or you go into your bedroom, or to the Organic Farm. It's the fact that they all can live and breathe together and in my estimation the best way to learn. [The edible forest garden] could become even a laboratory of sorts.

By incorporating tangible learning opportunities within the student residential area, it can transform living space into another avenue that enriches the student experience.

Three concept-based benefits were noted by a number of participants. First, approximately half (53%) touched upon the garden *conveying long-term ideas*. The project is seen as sparking ideas that students can take with them throughout their college career and into their future livelihoods. This is important in a world where so many of the things that young people encounter are about instant gratification. For those who participate in this sort of project planting perennial species is very important. As Sam Lanz explains, "Being able to set something up that you know is going to be there in 20 years is really cool too. I can plant a tree and when I come

back it will be big and old." *Developing a student feeling of ownership* was a benefit raised by approximately half (47%) of subjects. This feeling of ownership is noted in particular for this garden because (a) the garden creates an opportunity to link food-bearing species with one's place of residence, and (b) student workers and Sustainability Housing share the opportunity to maintain the space. Student buy-in is being supported by Evergreen Residential and Dining Services, who has offered ongoing financial support and the willingness to task appropriate student workers (the grounds crew, for example) with maintenance.

Many subjects (60%) also viewed the installation of an edible forest garden as an opportunity to *communicate concepts of "place"*. Place is a complex conceptual construction about the landscape and built environment around oneself (Gallagher 1994). Instead of merely viewing campus housing as temporary living with little to no attachment, gardens can contribute to making the living area more inviting, and encourage students to interact with their home at a greater level. Goodman explains, "I think the nice thing is that it makes a good gesture to the community that this is someone's home and not just somebody's place that they temporarily live [in]." Additionally, residents of campus housing tend to be younger, to have not lived away from home, and thereby are in a unique position as they craft their ideas of independent living and how their community and surroundings fit into their worldviews.

Some (33%) mentioned the practical benefits of the garden *requiring less maintenance* and inputs in the long-term. If successful, a few subjects (20%) saw that this project could serve as a model for success for other similar projects throughout campus. This is particularly useful as the Climate Action Plan for the campus includes a requirement for "Re-Greening" some lawns and bare spaces that

exist on the campus grounds, with a goal to begin planning for the reallocation of these spaces in the 2009-10 academic year, with installation to occur in 2010-11.

Sustainability Issues Addressed by Edible Forest Gardens

Edible forest gardens encompass concepts that span many disciplines, both practically and academically. They are addressed more completely in the literature review in Chapter 3. Subjects had varying knowledge of what edible forest gardens are, the theory behind them, and familiarity in experiencing them. Most subjects (79%) saw the garden as addressing sustainability issues associated with *land use* and *ecology*. Land use was seen as particularly important with this particular site, both because campus Housing had been debating what to do with the area, and because of its anticipated potential in raising residents' awareness of their surroundings. Therefore, the garden connects with land use issues (1) in that it is physically changing the land in that place, and (2) it has the potential to develop students' curiosity about land development theory. Ecology was a resounding theme as this type of gardening is intended to flourish within its environment, providing habitat and creating food at the same time.

The two sustainability issues that subjects mentioned with the next degree of frequency (64%) were *food systems* and *bioregional concepts*. In linking the garden with food systems, subjects drew connections with students observing how food plants grow, learning about perennial food plants, seasonality, food miles, producing food in place, and nutrition. Subjects saw the garden connecting with bioregional concepts in that it questions our mode of food production where we live. Aramark Sustainability Intern, Halli Winstead, explains, "You wouldn't find all those plants there in one place," even though a number of plants included *are* native.

The other main sustainability issue addressed by the forest garden noted by almost half of respondents (43%) was its relationship to *ethnobotany*. Ethnobotany addresses the social justice aspect of sustainability through the preservation of indigenous culture; also, retaining historical knowledge about the values of native plants makes an important contribution to developing a sustainable future. The inclusion of a high proportion of species traditionally used by Native Americans in the Pacific Northwest allows for cultural and ethnobotanical curricular connections. This connection was introduced in the *Food, Place, Culture* program, and Nate, a student from the class, describes, "[The edible forest garden workshops] went along with some of the Northwest tribes and the type of gardening they did, to propagate particular native plants here. They would grow them similarly to a forest garden, because they were in the wild, and would help the plant proliferate. … I think overall it's probably not a new phenomenon, its something we've rediscovered we can do."

Edible Forest Garden Connections to Teaching and Learning

Above, I've established a number of pathways for disciplinary integration of edible forest gardens into the curriculum, and that edible forest gardens can shed light on several pervasive themes within the broad concept of sustainability. Additionally, I've shown how both the subjects interviewed and the college as a whole as stated in its literature value the marriage of sustainability concepts with the curriculum. Now I will look more specifically at how the establishment of edible forest gardens contributes to a higher learning institution's teaching approach. How can they connect to a particular curriculum to provide experiential learning opportunities that help students link theory and practice while supporting their growth and development as community members?

Most (80%) subjects saw direct *curricular connections* between edible forest gardens and academic goals. There was a large variation in what were seen as ways for the garden to connect with the curriculum. They can work into the curriculum both by setting an example of disciplinary concepts (i.e. botany, ecology, soils, wildlife and habitat, agroecology, ethnobotany, food and nutrition, land use and planning, permaculture studies, sustainability studies) and by creating a place for learning scientific research methods, particularly in ecology or environmental analysis (i.e. measuring plant growth and survival, effects of light, shade and moisture).

The value of edible forest gardens to *experiential learning* was recognized by most (80%) subjects. In particular, student responses iterated their appreciation and acknowledgement for this type of learning through hands-on work. Student and Community Gardens co-coordinator Colin Bartlett asserts:

> I think having the beauty and the advantage of a fruit and vegetable garden, in some ways even over a purely native garden or a flower garden, is its interactivity, because you're reaching in there, and plucking these fruits, it gives you a greater sense of place. It's a landscape you interact with, not a landscape you just walk through.

Interview responses indicating the potential for experiential learning are reinforced by the survey results from students who were enrolled in the participating class program.

Putting *theory into practice* is one of Evergreen's five learning foci, and it is also a concept that was seen by almost half of interview subjects (47%) as a valuable contribution of the forest garden. This, also, was strongly echoed by students in the *Food, Place, and Culture* program, both in interviews and survey responses.

Almost half (47%) identified that edible forest gardens in the Housing area could contribute to *student growth and development*, both academically and personally. Since the garden will be largely student-coordinated and maintained, this offers opportunities for leadership as well as research skill development. The potential for independent contracts and internship learning opportunities also provides unique prospects for motivated students to grow.

Discussion

The above section details my findings about how edible forest gardens facilitate sustainability at The Evergreen State College. The qualitative data demonstrate the complexity institutions are faced with when making decisions about how to "green" their operations. The collaborative responses indicate the strength of potential benefits of the addition of edible forest gardens to the campus, that they are in line with the campus sustainability goals, and that the practical and curricular opportunities outweigh the challenges.

Evergreen's sustainability goals include communication and messaging, establishing a sustainability ethic, establishing a curricular pathway in sustainability, and improving operations. Edible forest gardens in the housing area offer a valuable teaching and learning experience, invite residents to make connections with bioregional concepts and a sense of place, and in theory will require less maintenance in the long-term. With proper signs identifying plants and explaining the concept, the gardens also closely fall in line with Evergreen's communication and messaging goals.

Many challenges were noted in executing a student-initiated garden installation project. The largest of these is the assurance of long-term continuity of a permanent

space in a transitory student environment. Several elements were also seen as necessary in projects that involved both staff and students: mainly collaboration and compromise, and the garnering of administrative support. The development of a clear plan on the students' part is also vital.

Despite these challenges, many benefits and opportunities emerged: the opportunity for long-term studies, the cultivation of student "ownership" on campus, and the opportunities for teaching and learning in multiple disciplines. Sustainability-related issues that forest gardens address include: land-use, ecology, food systems, ethnobotany, and bioregional concepts. Edible forest gardens on a college campus offer an opportunity for students to combine theory and practice, and provide experiential learning opportunities.

Chapter VI | Realizing Sustainability through the Lens of Edible Forest Gardens

To conclude, in this chapter I synthesize and expand upon information presented throughout the thesis, and situate the new research within the context of other work. I'll also make recommendations on how to incorporate this work into practice, and suggest areas of future research.

Edible Forest Gardens, Sustainability, and Higher Education

This study investigated whether the installation of an edible forest garden could facilitate sustainability knowledge in higher education, and if it is an important component of a campus sustainability plan. Whereas several studies note links between gardening and education in the K-12 learning environment, few address them within the context of sustainability and higher education. Edible forest gardening is an alternative approach in considering food production, offering an ecologically rooted approach attempting to maintain ecosystem function and create habitat.

Results of the study demonstrate the contribution of edible forest gardens as they pertain to sustainability in higher education. Before- and after-surveys and guided reflection responses demonstrate that learning about forest gardens helped to develop students' understanding of sustainability concepts, particularly about food issues and growing foods. The integration of the garden into the curriculum strongly addresses the college's learning foci. Qualitative interviews resulted in several themes emerging, which addressed six categories. To synthesize: edible forest gardens on a college campus foster teaching and learning both in classroom theory and in hands-on work; they touch upon several disciplinary topics; they

offer opportunities for long-term study and help to cultivate student ownership and sense of place; and they both act to spread the campus message of sustainability and demonstrate sustainable practices. Corresponding with Evergreen's sustainability goals, edible forest gardens can serve as a valuable component of the campus' sustainability efforts (TESC Sustainability Task Force 2006, TESC 2009a). Additionally, installing and maintaining edible forest gardens require collaboration between students and staff, presenting challenges and educational opportunities.

Teaching about edible forest gardens supports students learning how to link theory to practice, a skill needed for addressing sustainability issues in meaningful ways. Students in the *Food Place and Culture* program found the workshops to enhance their learning in four broad areas: planting, edible forest gardening concepts, garden installation process, and forest ecology concepts. Edible forest gardening relies on a foundational understanding of complex relationships between plants, soils, mycorrhizae, herbivores and pollinators (Jacke and Toensmeier 2005, Kimmins 2004, Liebman 1995, Soule and Piper 1992, Whitefield 2002). Therefore, there is significant opportunity to educate about ecological principles, integrating these into student perspectives on sustainability. Simultaneously providing a food option, the garden leads the observer to critically analyze our current modes of food production, and consider alternative modes of growing food. The service-learning component of the installation can help students to cultivate a sense of personal responsibility and environmental citizenship; the hands-on work providing a sense of satisfaction and translation of theoretical principles authentically realized (Newman 2008).

The work done by students engaging in independent study resulted in a transformative experience. Abigail Marshall demonstrated significant educational and personal growth, both academically and in terms of project organization. While

I coordinated the project, the outreach and networking she accomplished was only possible due to her immersion and depth of understanding of concepts inherent in edible forest gardening: two examples include a brochure she authored, and a cookbook detailing edible properties of the plants included. She volunteered with a local non-profit that installs forest gardens, furthering her knowledge on the subject and establishing community connections.

Communicating concepts of place and fostering the student feeling of ownership were two themes that arose as benefits of the garden. Because the gardens are situated within the housing area, they modify what students experience as their home – often their first independent living situation. Those who become active in their living environment can not only assemble a more coherent understanding of the bioregion, but also develop a greater sense of ownership of their residence. The garden has the potential to encourage residents to think about the meaning of a place. While students will not be able to truly feed themselves from the area, they will have the opportunity to taste native and unusual fruits, observe plant growth, and draw connections to the foods they consume. Those who participated in the installation had the opportunity to draw deeper connections with community, which in a sense is an extension of their natural surroundings. Interaction between the students and their current bioregion through research and coursework can benefit the community while contributing to students' academic and personal development (Keen and Baldwin 2004, Mkinne and Halfacre 2008).

Ownership is enhanced when students are allowed to make their own choices reflecting their interests (Mkinne and Halfacre 2008, VanDerZanden and Cook 1999). Many opportunities exist for future students to realize their visions in the space: adding plants, building trellises, pruning, weeding, and harvesting will all

invite student participation. Incorporating new student input while maintaining an established plan will be important, as others have commented how other gardens on campus (Demeter's Garden, for example) suffer when new student coordinators want to revision the space (Field notes 2009).

It is critical for any long-term student project to be supported both from the student and administrative levels. Inspired, impassioned students often need guidance to develop their ideas into a tangible reality. Having a detailed plan, being willing to make compromises, and making appropriate connections helped to secure this support from the start. Perseverance is also invaluable: when my initial grant was not funded, I sought donations, requested funding from the Residential and Dining Services department, and wrote a second grant which was successful. Funding projects can take considerable effort from students to seek out and apply for funds, and the college or university to ensure that there are monetary resources available.

The challenge of creating continuity will be unique in each situation. In this case, some positive events occurred which should counter potential problems. Over the summer of 2009, I was in close communication with the grounds crew, who worked to install a trail and a drip irrigation system. This integrated the garden further with typical work duties associated with their responsibilities. In fall 2009, a student who matriculated through the *Food, Place, and Culture* class and was very excited about the garden was hired for the Grounds Lead position. Another participant of the class was transferred to the grounds crew and charged with a sustainability-oriented focus. Abigail Marshall, mentioned above for her independent work with the project, is at the time of this writing in a paid Sustainability Coordinator position for Residential and Dining Services, allowing her to oversee some of the management of the space. These three key individuals will likely carry on their passion and care

for the space due to their enhanced feeling of ownership about it. I would like to see this develop into a cascading effect, in which they involve other students, thereby cultivating even longer-term interest in the space.

Overall, Residential and Dining Services provided a positive, supportive atmosphere for student project experimentation. When needed, RAD provided personnel and financial resources. Additionally, the smaller organizational framework of the satellite campus department allowed greater freedom for me to develop the project. Residential and Dining Services' institutional structure places a high degree of confidence in student work and student development. If operating within the context of the greater campus, I would have encountered a greater diversity of challenges and less supportive departments. Others who have worked to establish gardens in the main part of campus have expressed struggles in developing a proper maintenance plan in collaboration with the Facilities department on campus. Additionally, the site I developed in RAD was already identified as a place to modify; therefore, my ideas were typically seen as an improvement to the existing site. On the other hand, potential sites on the main part of campus invited controversy and resistance from the beginning.

The positive outlook for integration of the space into the fabric of the campus extends beyond Residential and Dining Services. Faculty members have expressed interest in integrating the garden into future coursework. Students independent of this project are in the initial stages of establishing forest gardens at the campus childcare center, using this case as a springboard for structural organization and maintenance regime. Evergreen's Climate Action Plan seeks to repurpose several lawns, and initial plans for their design will begin in the 2009-10 academic year;

this project exhibits a strategy for achieving sustainable grounds management that integrates significant student involvement and academic growth.

Confronting Additional Challenges

Several potential challenges could be encountered in the future. Some may not appreciate the aesthetic of a low maintenance garden. Also, annual gardeners may have a difficult time recognizing the benefits of a perennial food garden, or dismiss forest gardens as a fad. Others may consider that hands-on learning is not appropriate for college level education. I'll discuss these additional challenges in light of the other material presented within the thesis.

Resistance to Aesthetic. As the garden matures, its less tidy appearance as compared to a highly maintained garden or lawn may cause some to consider it an eyesore. Beck et al. (2002) found sustainability and aesthetics to be opposed in subjects' perceptions of gardens, but that people responded positively to informational materials. I highly recommend ample educational materials to be available via the web, and on-site. For this garden, placard signs were placed by 50 different plant species and varieties, and there are plans for an interpretive panel to be placed in the garden. The signs can discuss the benefits of low-maintenance and native species food gardening, and how it reflects a different aesthetic. A website features student-researched information on each plant species, a cookbook, and a guided walking tour.

Likewise, I recommend a thorough maintenance plan. While edible forest gardening and permaculture principles often boast "low-maintenance" as a benefit, this is not the same as "no-maintenance". The installation of the drip system highlights a method of minimizing water and energy use while exhibiting a labor-efficient

process for landscape maintenance. It is important that whoever is in charge of maintaining the space has an understanding of and access to resources detailing particular requirements by specific plants as necessary, as well as resources or knowledge on maintaining a drip irrigation system.

Resistance to Perennials in Home-Based Food Production Systems. Resistance to an edible forest garden may arise among annual gardeners. Food demand typically favors conventional crops: this is reflected in the species composition of our farmland and annual gardens, and in the dominant subject matter constituting ecological agricultural curriculum (Nelleman et al. 2009). Perennial food crops are not a component in the regularly taught ecological agriculture program at Evergreen. The concept at this time could not pervade or substitute for our conventional agricultural system. Employing an ecologically sound, food-bearing, locally sustaining system at an institutional level is not yet on the horizon, but encouraging the cultivation of a new frame of mind regarding our landscape is pertinent as we encounter sustainability challenges.

Edible Forest Gardening as a Fad. Critics could assert that edible forest gardening, or sustainability itself, are passing fads. I addressed sustainability and its growing presence on college campuses in Chapter 2, and demonstrated with data from student interviews how edible forest gardens offer a connection to campus sustainability and, in particular, how they support teaching and learning. But what about edible forest gardens themselves? Are they a gardening technique currently in vogue that will be forgotten in a few years?

The definition of edible forest gardens is flexible enough to include a wide range of edible landscapes based on ecological principles (Hart 1991, Jackson 2002). It has

been adapted from its ideal to a heavily shaded, high-moisture area at Evergreen. Forests have been managed by humans over millennia, and food production based on ecological principles is a method of maintaining forest function and biodiversity (McNeely 2004). As we make amends with our surroundings and develop restoration plans while confronting challenges with sustainable food issues, edible forest gardening arises as a sensible solution. It is only a part of a greater solution in developing sustainable campuses within sustainable societies. There are tradeoffs as one designs for maximum food yield, minimal maintenance, or native area restoration goals. As demonstrated throughout history in Chapter 3, edible forest gardens have been realized in many areas of the globe, adapted to tropical and temperate climates, native and cultivated species. Though newly introduced under the guise of edible forest gardening, this relationship is embedded in place as traditional ecological knowledge.

Beyond the Evergreen State College Campus

Working in the sustainability field at an institutional level presents a suite of uncharted struggles. Identifying and analyzing successful campus sustainability projects contributes to this relatively new field. Hundreds of campuses are authoring Climate Action Plans and contending with how they will meet their sustainability goals; currently, there are few guiding models (ACUPCC 2009). Because of the adaptability of edible forest gardens to site dimensions, soil conditions, and climate, practically any campus can include an edible forest garden on its grounds. This case study demonstrates what worked at Evergreen, why it worked, who acted as key players in supporting it, an outline of the process, and plans for the future. Similar volunteer-driven garden establishment projects present comparable challenges (Mkinne and Halfacre 2008). While each institution varies, this process

can be translated to other colleges and universities on their own route towards sustainability.

Tangible experiences highlighting the educational material from the classroom can positively influence student learning, particularly in regards to the concept of sustainability (Alvarez and Rogers 2006, Hamilton 1999). Sited on campus as a demonstration and teaching opportunity, the garden offers outdoor learning benefits without necessitating a field trip. Surveys indicated students' appreciation for hands-on experiences complementing classroom learning. Without incurring the financial cost, paperwork requirements, travel time or carbon emissions to arrive at a field destination, on-site edible forest gardens provide a number of the advantages that an educator may seek in organizing such a trip. Some examples include: botanical illustration, ecological monitoring or instrument demonstration, ethnobotanical demonstration, plant identification, nature writing, ecological art discussions, and sustainable design examples. The garden also provides a place to teach about place and bioregional topics, and sustainable grounds management.

Because the garden is situated on a college campus, there is great potential for the concept of edible forest gardening to be contagious. The student body consists of young people from across the nation and from varied backgrounds who are at a transformational period in cultivating their ideas and life journeys. Exposure to the idea of edible forest gardening is something they can bring back to their hometown, and share with their families and friends. Student responses in surveys indicate that though many of them can't currently implement a forest garden of their own, they have amassed tools for the future, and gained an aesthetic for managing a landscape for beauty, food, and wildlife.

Though most directly applicable to other campuses, the findings here indicate that edible forest gardens, as a sustainable approach to grounds management, can be generalized to private and other public lands. Directly applicable to the current advances in the urban agriculture and local foods movement, public understanding of edible forest gardens as a sustainable solution can lead to them being integrated into policy of managing public land such as parks or community gardens. This gardening approach also would appeal to property owners who are interested in growing a percentage of their own foods but cannot allocate the time or energy required to maintain an annual vegetable garden.

Areas for future research

The work of this thesis raises many questions. Recommended areas for future research are twofold. First of all, additional work should be conducted on college campuses to assess the relationships between gardens and sustainability education. How does the Evergreen model compare to that of other institutions? Secondly, the research lays a foundation for future work to be conducted at this site. One of the greatest limitations of research was the time frame: the current work begs further investigation on the longer-term effects of an edible forest garden on student learning in the areas of environmental education and sustainability. The perspectives and responses of future residents who are less connected to the installation process would provide additional insight. Research could also focus on quantitative changes in resource use (i.e. water savings with drip irrigation), quantifying food production in the mature garden, or focus on ecological community studies. More research is needed about species interactions in agroforestry systems (Jose et al. 2004). The site could be monitored for changes in moisture regime, soil chemistry, or insect community composition. Class programs in multiple areas of

study (i.e. botany, forestry, food systems, ethnobotany, biology, ecology, psychology, sustainability studies) might be involved over an extended period of time.

Conclusion

Edible forest gardens are a valuable addition to the housing area of The Evergreen State College campus. Contributing to student learning while exemplifying a sustainability solution, the project transcends multiple disciplines while building community and improving ecosystem function. As Evergreen implements its Climate Action Plan, it should ensure the addition of edible forest gardens throughout the campus core, particularly where student involvement can be encouraged. This thesis demonstrates the benefits of the installation of edible forest gardens on a college campus, addresses and confronts potential obstacles, and provides a model for moving forward.

Other schools promoting sustainability efforts can use this project and process as a template when considering how to manage their grounds using a method that enriches ecological habitat while simultaneously offering food to the campus community. In considering the bigger picture, it is the way we as humans interact with the biotic and abiotic factors surrounding us that will determine the long-term balance of our coexistence with the planet. Edible forest gardens seek to employ ecological design paradigms to promote a healthy balance between human and ecosystem needs. The effects of converting more land area into multifunctional space can transform the way we envision urban and suburban areas as we develop sustainable societies.

References

AASHE. 2008b. Sustainability Tracking, Assessment, and Rating System (STARS) for Colleges and Universities: Version 0.5. Association for the Advancement of Sustainability in Higher Education. Lexington, Kentucky. 118 pp.

AASHE. "Sustainable landscaping." Website for the Association for the Advancement of Sustainability in Higher Education. Accessed September 29, 2009. www.aashe.org.

AASHE. "AASHE Membership." Website for the Association for the Advancement of Sustainability in Higher Education. Accessed April 17, 2009. www.aashe.org.

AASHE. "Campus Sustainability Leadership Awards." Website for the Association for the Advancement of Sustainability in Higher Education. Accessed April 22, 2009. www.aashe.org.

Abrams MD, Nowacki G. 2008. Native Americans as active and passive promoters of mast and fruit trees in eastern North America. The Holocene 18(7):1123-1137.

ACUPCC. "President's climate commitment and climate action planning." Website for the Association of College and University Presidents' Climate Commitment. Accessed September 28, 2009. www.presidentsclimatecommitment.org

Adler PA, Adler A. 1987. Membership roles in field research. Newbury Park, California: Sage.

Altbach PG. 1974. Comparative university reform. In: Altback PG editor. University Reform.. Cambridge, Massachusetts: Schenkman Books. p. 1-14.

Alvarez A, Rogers J. 2006. Going "out there": learning about sustainability in place. International Journal of Sustainability in Higher Education 7:176-188.

Anderson MK. 2005. Tending the wild: Native American knowledge and the management of California's natural resources. Berkeley, California: University of California Press. 526 pp.

Angehrn, A. 2004. Learning-by-playing: bridging the knowing-doing gap in urban communities. In: Bounfour A, Edbinsson L, editors. 2005. Intellectual capital for communities. Burlington, Massachusetts: Elsevier. p. 299-316.

Barbour M, Burk J, Pitts W, Gilliam F, Schwartz M. 1999. Terrestrial Plant Ecology. 3rd ed. Menlo Park, California: Benjamin Cummings. 649 pp.

Beard JS. 1973. The physiognomic approach. In: Whittaker RH, editor. Ordination and Classification of Communities. Part 5, Handbook of Vegetation Science. The Hague: W. Junk b.v. Publishers. p. 355-386.

Beck TB, Heimlich JE, Quigley MF. 2002. Gardeners' perceptions of the aesthetics, manageability, and sustainability of residential landscapes. Applied Environmental Education and Communication 1:163-172.

Bompard JM, Ducatillion C, Hecketsweiler P, Michon G. 1980. A traditional agricultural system: village, forest gardens in West Java. Montpellier, France: University of Montpellier.

Bowcutt F. 2002. Imagine a Greener Future:An Arboretum Draft Plan for the Evergreen State College. Unpublished Report. Olympia, WA: The Evergreen State College.

Bowcutt F. 2008. Appedix O: Imagine a Greener Future: An Arboretum Plan for the Evergreen State College. In: The Evergreen State College Master Plan. Olympia, Washington: The Evergreen State College. p. 275-318.

Brown, Katharine H. and Anne Carter. 2003. Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe. Community Food Security Coalition, Venice, California.

Bradley P, Marulanda C. 2007. A Study on microgardens that help reduce global poverty and hunger. Acta Horticulturae (ISHS) 742:115-123.

Capra F. 1998. Ecology, Systems Thinking, and Project-Based Learning. Sixth Annual Conference on Project-Based Learning. San Francisco, California: Center for Ecoliteracy.

Certini G. 2005. Effects of fire on properties of forest soils: a review. Oecologia 143(1):1-10.

Chalker-Scott L. 2007. Impact of mulches on landscape plants and the environment - a review. Journal of Environmental Horticulture 25(4):239–249

Chapin FS III, Walker BH, Hobbs RJ, Hooper DU, Lawton JH, Sala OE, Tilman D. 1997. Biotic control over the functioning of ecosystems. Science 277:500-504.

Christianty L, Abdoellah OS, Marten GG, Iskandar J. 1986. Traditional agroforestry in west Java: the pekerangan (homegarden) and kebun-talun (annual-perennial rotation) cropping system. In: Marten GG, editor. 1986. Traditional agriculture in southeast Asia. Boulder, Colorado: Westview. p. 132-158.

City Farmer. 2002. 44% of Vancouver households grow food. Canada's Office of Urban Agriculture. Accessed May 4, 2009. www.cityfarmer.org.

Civil NM. 2007. Building on community knowledge: an avenue to equity in mathematics education. In: Nasir, N, Cobb P, editors. Improving access to mathematics: Diversity and equity in the classroom. New York, New York: Teachers College Press.

Corcoran PB, Wals AEJ, editors. 2004. Higher education and the challenge of sustainability: problematics, promise, and practice. Dordrecht, Netherlands: Kluwer Academic Publishers. 355 pp.

Cortese AD. 1992. Education for an environmentally sustainable future: A priority for environmental protection. Environmental Science and Technology 26(6):1108-1114.

Cortese AD. 2003. The critical role of higher education in creating a sustainable future. Planning for Higher Education 3:15-22.

Cox GW, Atkins MS. 1979. Agricultural ecology: an analysis of world food production. Cambridge, United Kingdom: WH Freeman & Co.

Cox TS, Glover JD, Van Tassel DL, Cox CM, DeHaan LR. 2006. Prospects for developing perennial grains. BioScience 56(8):649-659.

Creighton SH. 1999. Greening the ivory tower: improving the track record of universities, colleges, and other institutions. London: MIT Press. 337 pp.

Crews TE. 2005. Perennial crops and endogenous nutrient supplies. Renewable Agriculture and Food Systems 20(1): 25-37.

de Bon H. 2006. Dry and aquatic peri-urban and urban horticulture in Hanoi, Vietnam. In: van Veenhuizen R, editor. Cities farming for the future – urban agriculture for green and productive cities. Phillipines: ETC-Urban Agriculture. p. 338-339.

FAO. 1989. Prevention of post-harvest food losses: fruits, vegetables, and root crops. Rome: FAO Newsroom.

FAO. 2005. Farming in urban areas can boost food security. FAO Newsroom, Rome.

Garden JG, McAlpine CA, Possingham HP, Jones DN. 2007. Habitat structure is more important than vegetation composition for local-level management of native terrestrial reptile and small mammal species living in urban remnants: A case study from Brisbane, Australia. Australian Ecology 32:669-685.

Gallagher W. 1994. The power of place: how our surroundings shape our thoughts, emotions, and actions. New York: Poseidon Press. 240 pp.

Glover JD. 2005. The necessity and possibility of perennial grain production systems. Renewable Agriculture and Food Systems 20(1):1-4.

Graham H, Beall, DL, Lussier, M, McLaughlin P, Zidenberg-Cherr, S. 2005. Use of school gardens in academic instruction. Journal of Nutrition Education Behavior 37:147-151.

Graham H, Zidenberg-Cherr S. 2005. California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. Journal of the American Dietetic Association. 105: 1797-1800.

Groom MJ, Meffe GK, Carrol CR. 2006. Principles of Conservation Biology. 3rd edition. Sunderland, Massachusetts: Sinauer Associates, Inc. 779 pp.

Groombridge B, Jenkins MD. 2002. World atlas of biodiversity: Earth's living resources in the 21st century. Cambridge, United Kingdom: UNEP World Conservation Monitoring Center. 340 pp.

Hanley M.L. 1991. After the harvest. World Development 4(1): 25-27.

Hamilton SL. 1999. The roles of the University of Tennessee gardens in a public horticulture teaching program. Horticultural Technology. 9(4): 552-556.

Hart, RA. 1991. Forest gardening. Totnes, Devon, United Kingdom: Green Books.

Harvey JR. 1984. Vegetables in the middle ages. Garden History 12(2):89-99.

Higgs AL, McMillan VM. 2006. Teaching through modeling: four schools' experiences in sustainability education. The Journal of Environmental Education 38(1):40-53.

Hoogerbrugge ID, Fresco LO. 1993. Homegarden systems: agricultural characteristics and challenges. London: Sustainable Agriculture Programme, International Institute for Environment and Development, London.

Hora M, Tick J. 2001. From farm to table: making the connection in the mid-Atlantic food system. Washington, DC: Capital Area Food Bank.

Jacke D, Toensmeier E. 2005. Edible forest gardens: ecological vision and theory for temperate climate Ppermaculture. Volumes I and II. White River Junction, Vermont: Chelsea Green Publishing Company.

Jackson W. 2002. Natural systems agriculture: a radical alternative. Agriculture, Ecosystems and Environment 88: 111-117.

James,D.G. 1986. The prospects for fish for the malnourished. Food and Nutrition 12(2):20-30.

Jose S, Gillespie AR, Pallardy SG. 2004. Interspecific interactions in temperate agroforestry. Agroforestry Systems 61:237-255.

Keen C, Baldwin E. 2004. Students promoting economic development and environmental sustainability: an analysis of the impact of involvement in a community-based research and service learning program. International Journal of Sustainability in Higher Education 5:384-394.

Kimmins JP. 2004. Forest Ecology: A Foundation for Sustainable Forest Management and Environmental Ethics in Forestry. Upper Saddle River, New Jersey: Pearson Education, Inc. 611 pp.

Kumar BM, Nair PKR. 2004. The enigma of tropical homegardens. Agroforestry Systems 61:135-152.

Leopold EB, Boyd R. 1999. An ecological history of old prairie areas in southwestern Washington. In: Boyd R. Indians, fire, and the land in the Pacific Northwest. Corvallis, Oregon: Oregon State University Press. p. 139-163.

Liebman M. 1995. Polyculture cropping systems. In: Altieri M, editor. Agroecology: The Science of Sustainable Agriculture, 2nd ed. Boulder, Colorado: Westview Press. p. 205-218.

Lundgren BO. 1982. What is Agroforestry? Agroforestry Systems 1(1):7–12.

Lundqvist J, de Fraiture C, Molden D. 2008. Saving water: from field to fork – curbing losses and wastage in the food chain. SIWI Policy Brief. Stockholm, Sweden: Stockholm International Water Group.

McAleese JD, Rankin LL. 2007. Garden-based nutrition affects fruit and vegetable consumption in sixth-grade adolescents. Journal of the American Dietetic Association 107:662-665.

McNeely JA. 2004. Nature vs. nurture: managing relationships between forests, agroforestry and wild biodiversity. Agroforestry Systems 61:155-165.

M'Gonigle M, Starke J. 2006. Planet U: sustaining the world, reinventing the university. Gabriola Island: New Society Publishers. 270 pp.

Michon G, Bompard JM, Hecketsweiler P, Ducatillion C. 1983. Tropical forest architectural analysis as applied to agroforests in the humid tropics: the example of traditional village-agroforests in West Java. Agroforestry Systems 1:117-129.

Mkinne KL, Halfacre AC. 2008. "Growing" a campus native species garden: sustaining volunteer-driven sustainability. International Journal of Sustainability in Higher Education 9:147-156.

Mollison B. 1988. Permaculture: A Designer's Manual. Tyalgum, Australia: Tagari Publications. 575 pp.

Morgan SC, Hamilton SL, Bentley ML, Myrie S. 2009. Environmental education in botanic gardens: exploring Brooklyn botanic garden's Project Green Reach. The Journal of Environmental Education 40(4):35-52.

Murphy K. 2009. Evaluating the Sustainability Tracking, Assessment, and Rating System (STARS) at The Evergreen State College [Masters thesis]. Olympia, WA: The Evergreen State College. 179 pp.

Nabhan G. 2008. Where our food comes from: retracing Nikolay Vavilov's quest to end famine. Washington: Island Press. 214 pp.

NWF. 2008. Campus environment 2008—a national report card on sustainability in higher education: trends and new developments in college and university leadership, academics, and operations. National Wildlife Federation and Princeton Survey Research Associates International. 136 pp.

Nellemann C, MacDevette M, Manders T, Eickhout B, Svihus B, Prins AG, Kaltenborn BP, editors. 2009. The environmental food crisis – The environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Programme, GRID-Arendal. 104 pp. www.grida.no

Newman J. 2008. Service learning as an expression of ethics. New Directions for Higher Education 142:17-24.

Norton H. 1979. The association between anthropogenic prairies and important food plants in western Washington. Northwest Anthropological Research Notes 13(2):175-200.

Ozer EJ. 2006. The effects of school gardens on students and schools: conceptualization and considerations for maximizing healthy development. Health Education and Behavior 34:846-864.

Pearson KL. 1997. Nutrition and the early medieval diet. Speculum 72(1): 1-32.

Pinstrup-Andersen P, Pandya-Lorch R. 1998. Food security and sustainable use of natural resources: a 2020 vision. Ecological Economics 26(1):1-10.

Pirog R. 2004. Food miles: a simple metaphor to contrast local and global food systems. Hunger and Environmental Nutrition, Dietetic Practice Group of the American Dietetic Association. 5 pp.

Pirog R, Benjamin A. 2003. Checking the food odometer: comparing food miles for local versus conventional produce sales to Iowa institutions. Ames, Iowa: Leopold Center for Sustainable Agriculture, Iowa State University. 8 pp.

Pirog R, Van Pelt T, Enshayan K, Cook E. 2001. Food, fuel, and freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions. Ames, Iowa: Leopold Center for Sustainable Agriculture, Iowa State University.

Princeton Review. 2008. Best 368 Colleges, 2009 Edition. Princeton Review. 832 pp.

Putnam, J, Allshouse J. 2001. Imports' share of US diet rises in late 1990s. Global Food Trade 24(3):15-22.

Poppendieck J. 1997. The USA: hunger in the land of plenty. In: Riches G, editor. First world hunger. New York: St. Martin Press. p. 134-164.

Raab L. 2009. Greener RecycleManiacs participate in national competition. Olympia, WA: MESsages: The Newsletter of the Graduate Program on the Environment, The Evergreeen State College.

Rackham O. 2002. The medieval countryside of England: botany and archaeology. In Howe J, Wolfe M, editors. Inventing medieval landscapes: senses of place in western Europe. Gainesville, FL: The University Press of Florida. p. 13-32.

Sharp L. 2002. Green campuses: the road from little victories to systematic transformation. International Journal of Sustainability in Higher Education 3(2):128–145.

Soule JD, Piper JK. 1992. Farming in Nature's Image: An Ecological Approach to Agriculture. Covelo, CA: Island Press. 286 pp.

Stake R. 2000. 'Case Studies'. In: Denzin NK, Lincoln YS. Handbook of Qualitative Research. 2nd Edition. California: Sage Publications.

Storm L, Shebitz D. 2006. Evaluating the purpose, extent, and ecological restoration applications of indigenous burning practices in southwestern Washington. Ecological Restoration 24(4):256-268.

TESC. 2009a. Climate action plan: carbon neutrality in 2020. Draft. Olympia, Washington: The Evergreen State College.

TESC. 2009b. 2009 ACUHO-I/EBI Resident Study – unpublished data. Olympia, Washington: The Evergreen State College.

TESC. "The Evergreen State College Fall 2008 – Spring 2009 Course Catalog." The Evergreen State College. Accessed April 22, 2009. www.evergreen.edu/catalog/2008-09/.

TESC. "The Seminar II Building." The Evergreen State College. Accessed October 2, 2009. www.evergreen.edu/sustainability/evergreenstories/SeminarIIBuilding.

TESC Sustainability Task Force. 2006. Sustainable Evergreen: Evergreen's vision for a sustainable future - interim report. The Evergreen State College. Available online: www.evergreen.edu/sustainability/interimreport.htm

UNESCO. 1972. The Stockholm Declaration. Stockholm: UNESCO. Available online: www.unesco.org/iau/sd/sd_declarations

UNESCO. 1990. The Talloires Declaration. Gland: UNESCO. Available online: www.ulsf.org/programs_talloires

UNESCO. 1997. Thessaloniki Declaration. Gland: UNESCO. Available online: www.unesco.org/iau/sd/sd_declarations

University of Washington Botanical Gardens. "UWBG About Us – Frequently Asked Questions." University of Washington Botanical Gardens. Accessed July 20, 2009. depts.washington.edu/urbhort

VanDerZanden AM, Cook T. 1999. A multifunctional horticulture teaching garden at Oregon State University. Horticulture Technology 9(4):549-551

Verheij E. 1982. Homegardening in the Matara district. Temperate fruits in Numara Eliya district; report of a visit to Sri Lanka from 22 to 28 of August 1982. LH, Wageningen.

The Washington Center for Improving Undergraduate Education. 2008. Building concepts of sustainability into undergraduate curriculum. Olympia, Washington: Curriculum for the Bioregion Initiative, The Evergreen State College.

Wilcove DS, Rothstein D, Dubow J, Phillips A, Losos E. 1998. Quantifying threats to imperiled species in the United States. Bioscience 48:607-616.

Whitefield P. 2002. How to Make a Forest Garden. 2nd Edition. White River Junction, Vermont: Chelsea Green Publishing Company. 160 pp.

Wright TSA. 2002. Definitions and frameworks for environmental sustainability in higher education. International Journal of Sustainability in Higher Eduation. 3(3): 203-220.

Appendix I

Food Place and Culture Pre-Survey

This questionnaire was used with students in the interdisciplinary program Food Place and Culture. 48 students filled this out in the first week of class, before their experience in the garden.

On a scale of 1-7 (7 is high) assess your current understanding of **sustainability issues**.
On a scale of 1-7 (7 is high) assess your current understanding of **food issues**.
On a scale of 1-7 (7 is high) assess your current understanding of **edible forest gardening**.

Indicate up to three places you typically shop for your groceries, and prioritize (1 indicates you shop there most, 3 the least of your shopping habits)
___ Co-op
___ Locally Owned Market (i.e. Thriftway)
___ Farmer's Market (in season)
___ Discount Market (i.e. Grocery Outlet)
___ Grocery Store (i.e. Safeway, Top Foods, Alberson's)
___ Supermarket/Superstore (i.e. Wal-Mart, Costco)
___ Corner store (i.e. Handy Pantry, gas stations)
___ Other (please note)

Indicate the number of meals each week you typically eat…
___ At the Greenery.
___ Other on campus food options (i.e. the Market, Sem II Café)
___ Campus-run student café (Flaming Eggplant)
___ Fast food (McDonald's, Jack-in-the-box)
___ Low-budget restaurants (<$8/entree)
___ Mid-range restaurants ($8-15/entree)
___ Expensive restaurants (>$15/entrée)
___ At home.
___ Potlucks.

Define local in your own terms or understanding as it applies to food.
Estimate…
What percentage of food that you eat is **local**?
0-15 15-25 25-50 50-75 75+
What percentage of food that you eat is **organic**?
0-15 15-25 25-50 50-75 75+
In how many meals each week do you eat **meat**?
0 1-3 4-6 7-10 10+

How many months (or years) have you lived in the Pacific Northwest? Do you feel a **developing sense of place** with the bioregion here? How does this compare to where you have previously lived (if you have recently moved to the PNW)?

Describe your attentiveness to **food origin** and whether food is **organically grown**?

What does a **garden** mean to you? **Are you planning to grow a garden** this year? If so, will you grow any fruits or vegetables? Why or why not?

Appendix II

Food Place and Culture Post-Survey

This questionnaire was used with students in the interdisciplinary program Food Place and Culture. 31 students filled this out in the seventh week of class, after their experience in the garden.

On a scale of 1-7 (7 is high) assess your current understanding of **sustainability issues**.
On a scale of 1-7 (7 is high) assess your current understanding of **food issues**.
On a scale of 1-7 (7 is high) assess your current understanding of **edible forest gardening**.

Indicate up to three places you typically shop for your groceries, and prioritize (1 indicates you shop there most, 3 the least of your shopping habits)
___ Co-op
___ Locally Owned Market (i.e. Thriftway)
___ Farmer's Market (in season)
___ Discount Market (i.e. Grocery Outlet)
___ Grocery Store (i.e. Safeway, Top Foods, Alberson's)
___ Supermarket/Superstore (i.e. Wal-Mart, Costco)
___ Corner store (i.e. Handy Pantry, gas stations)
___ Other (please note)

Indicate the number of meals each week you typically eat…
___ At the Greenery.
___ Other on campus food options (i.e. the Market, Sem II Café)
___ Campus-run student café (Flaming Eggplant)
___ Fast food (McDonald's, Jack-in-the-box)
___ Low-budget restaurants (<$8/entree)
___ Mid-range restaurants ($8-15/entree)
___ Expensive restaurants (>$15/entrée)
___ At home.
___ Potlucks.

Define local in your own terms or understanding as it applies to food.
Estimate…
What percentage of food that you eat is **local**?
0-15 15-25 25-50 50-75 75+
What percentage of food that you eat is **organic**?
0-15 15-25 25-50 50-75 75+
In how many meals each week do you eat **meat**?
0 1-3 4-6 7-10 10+

How many months (or years) have you lived in the Pacific Northwest? Do you feel a **developing sense of place** with the bioregion here? How does this compare to where you have previously lived (if you have recently moved to the PNW)?

Describe your attentiveness to **food origin** and whether food is **organically grown**?

Have your shopping or eating habits changed over the past 2 months? (circle one) Yes/No
Why or why not?

What does a **garden** mean to you? Have your ideas of gardening changed in the last two months?

Have you changed your plans regarding **growing a garden** this year? i.e., if you did not plan one, have you changed your mind? If you had planned to grow something, have you changed your perspective on what to include?

Do you think you will **return to this garden** in the future? Yes/Maybe/No
Why or why not?

Are you interested in **caring for this garden** in your tenure at Evergreen? Yes/Maybe/No
Why or why not?

What are your thoughts on **returning to the gardens** now after your experience in helping to plant?

Did learning about edible forest gardens **directly impact** your understanding of:
(1 is not at all, 7 is a whole lot)

Sustainability	1	2	3	4	5	6	7
Food Issues	1	2	3	4	5	6	7
Growing Food/Plants	1	2	3	4	5	6	7

Have the workshops with the forest gardens addressed any of **Evergreen's 5 learning foci**?
(1 is not at all, 7 is a whole lot)

Interdisciplinary Study	1	2	3	4	5	6	7
Collaborative Learning	1	2	3	4	5	6	7
Learning Across Significant Differences	1	2	3	4	5	6	7
Personal Engagement	1	2	3	4	5	6	7
Linking Theory with Practice	1	2	3	4	5	6	7

How have the workshops with the forest gardens **augmented your classroom learning experience**?

Appendix III

Typical Interview Questions

This list incorporates most questions selected for semi-structured interviews. Each interview emphasized the unique inputs of person I was talking with, and I did not hesitate to use follow-up questions that are not listed here.

How did you hear about forest gardening?
Why did you install a food forest garden?
What are some of the joys and challenges of your garden?
What does it mean to you to have a sense of place?
In your opinion, how does participation in a community gardening project affect your sense of place?
How long have you lived in the area? Do you feel a developing sense of place with the bioregion here?
How does this compare to where you have previously lived (if a student who has recently moved to the PNW).
Have your perceptions changed in regards to food systems since the installation of your garden?
What do you see as potential challenges, as well as positive results of the installation of the gardens in the Housing area?
Tell me your thoughts about gardening with edible perennial plants.
Why did you get involved with the Edible Forest Gardens project?
Has it changed your perception of food origin? Food systems? Gardening?
Do you plan to do anything differently as a result of your involvement with the project?
How does your organization work to increase awareness or understanding of environmental or sustainability issues?
What are some of the joys and challenges of your work?

Appendix IV

Project Outline and Description

Many of the project details were eliminated from the body of the thesis as they distracted from the focus of the research. This appendix provides additional details of the plan and process.

Project Outline: Installing Edible Forest Gardens in Housing at TESC

1) Garden installation: project timeline, outline, logistics
   a. Institutional process
   b. Garden design
   c. Creating maintenance plan
   d. Designing educational materials
2) Experiential or Service Learning Education
   a. Student interns
   b. Class program
   c. Volunteers
3) Campus and community partnerships
   a. Community Gardens
   b. Developing Ecological Agricultural Practices Student Group
   c. Organic Farm
   d. Terra Commons
   e. Thurston Conservation District
   f. Residential and Dining Services

Project Description and Details

Garden installation: project timeline, outline, logistics

The first part of the process largely consisted of project management work. As the current Sustainability Coordinator for RAD Services, I undertook the process of attaining campus approval for installation of a garden, researching plants to include, assessing site drainage and light availability, ordering soils tests, developing garden layout and design, arranging for all materials required to do the garden installation (soil, mulch, cardboard, plants, mushroom inoculant, tools).

Institutional process

In order to do a garden installation in an institutional setting, I first explored how this process occurs in the campus setting at TESC. I worked with students, faculty, operational staff, RAD Services facilities, and got a proposal approved by the Campus Land Use Committee (CLUC) to install the garden. I also navigated funding opportunities and sought out donations for materials.

Garden design

Initial responsibilities included conducting an assessment of current site conditions. This included observation of existing plant species, observation of drainage patterns, soils tests in field and lab, and observations of the use of the site. I did this in collaboration with an undergraduate student intern throughout Winter Quarter 2009.

Based on results from the site assessment, we determined that the site is part-to-full shade, with mesic-to-hydric soils that in some areas have poor drainage. As is true of native Pacific Northwest soils, the soil is acidic, and is low in phosphorus and nitrogen in some areas.

The garden design was developed in an effort to pick the most appropriate and diverse plants for the existing site, rather than seek extensive modifications to the soil or the light availability. Although this presented a design challenge, it allowed the focus to incorporate more native plant species, and to allow this space to further demonstrate the potential that exists in a shady site with poor drainage. Plant species were chosen based on edibility, adaptability to site conditions, availability at local nurseries specializing in native and edible perennial plant species (Native Plant Salvage Project, Sound Native Plants, Stellaria Nursery, and Burnt Ridge Nursery). Due to the nature of the above limitations, an extensive suite of berries was selected, while limited varieties of perennial vegetables, tubers, and fruit trees were incorporated.

Creating maintenance plan

One of the main problems I encountered was considering the long-term maintenance for this garden. Since it is a transitory student environment with a lack of long-term institutional memory, there is potential for varying interest in the long term due to the variance of student body. For this reason, I drew up a plan to distribute the responsibilities between varying student organizations on campus. This plan includes four critical stakeholders: the RAD Services Grounds Crew, students living in Sustainability Themed Housing, the Sustainability Intern, and a network of campus and community groups. Each group will play a critical role, but this network should provide internal checks and balances so that if one group is not carrying out their part, another can take over to provide instruction and maintenance for the garden in that period of time.

The RAD Services Sustainability intern position is in a period of evolution, as it is currently a new position at TESC. Although this creates some challenges in that there is little structure at this point, it provides the opportunity to charge this position with coordinating the key players who will be contributing to the garden's future. Although I have an active interest in this project, I understand that my successor may not, and that this person may merely ensure that the workshops occur and that this program continues.

The RAD Services Grounds Crew, currently in charge of maintaining the grounds in the Housing area, will be charged with upkeep of the area. The current lead, Sam Lantz, has taken an active interest in assisting with the installation of the garden. Grounds maintenance staff brought mulch and installed the drip irrigation system for the site. They will ensure that the area does not become trashy, overgrown, and depending on their interest, can serve as a voice in the choices that will be made in the gardens. They also will take care of the watering, particularly in the first three years. They are the familiar face that students will see acting in these areas.

Students living in Sustainability Themed Housing will have the opportunity to opt-in to a group that maintains the garden space. They will have the opportunity to opt in to caring for the garden and harvesting its goods. They will do the weeding, the replanting, the sowing, and the trimming / pruning.

The last piece of the network consists of other campus and community groups. To create a learning environment and to help students who may have very little experience in caring for plants, community groups will be invited to give workshops on topics that will enhance the students' ability to care for and make informed decisions about the future of the garden. Groups will give an annual workshop unless they have the interest and capacity to do more.

This will provide students with the tools to make the garden a living space for learning. It will also provide the workshop leaders with direct contact with interested students on our campus, increasing recognition, possibly leading to internships, student collaboration, etc.

Designing educational materials
In order to provide structure and guidance for future caretakers, I laid out several documents to create that would include exhaustive but easily accessible information about the species included on the site. This includes: species profiles of all species currently included, a list of potential future actions that can or should be taken in caring for the garden, a maintenance manual that includes a timeline for how to care for the garden throughout the seasons, and an interpretive walk. These documents are all uploaded and available to current students and the wider public on the Residential and Dining Services Sustainability website.

Educational opportunities
There were several opportunities to create educational opportunities throughout the creation of the garden, as well as in laying out a plan for it serving as a demonstration in the future. I worked with three student interns, the full-time class program Food, Place, and Culture, (50 students), and volunteers.

Student Interns
At Evergreen, students have the ability to gain course credit for participating in an internship. This allowed for students to independently take charge of work to design and install the garden. Three students engaged in this manner throughout Winter and Spring 2009 academic quarters.

In the winter quarter of 2009, undergraduate Abi Marshall outlined a 12-credit internship project to help with site assessment and design, and creation of outreach and education materials. In the spring of 2009, Abi continued her work in the spring through an internship component of the program Living in the Sacred Garden, actively participating in leading garden installation, and completing development of education materials.

Two students, Sarah Betcher, and Kaliegh Phillips did 4-credit internship projects developing education materials. Sarah developed an interpretive walk and was the primary liaison to the Thurston Conservation District regarding soils testing, and Kaliegh designed plant profiles.

This process allowed these students to work independently and learn about edible forest gardens while narrowing in on their interests. They had an intimate opportunity to engage in and fulfill specific project needs.

Class program
The program Food, Place, and Culture participated in a workshop co-hosted by Natalie Pyrooz, Residential and Dining Services Sustainability Coordinator and Michael Kelly, of Terra Commons. The workshop occurred during the second week of the quarter, and began with a class presentation, and then lab time where students learned species and plant uses, and planted up a section of the garden. Students returned to the garden in the latter part of the quarter to observe its development.

Volunteers

Volunteers were an integral part of the planting process. The Center for Community Based Learning and Action helped to recruit volunteers. Most of them attended for the day of the garden installation only. One student, Rebecca Swain-Sugarman, conducted video documentation of the event.

Campus and community partnerships

Campus groups that will be involved are Demeter's Garden, Community Gardens, and the Environmental Resource Center. Demeter's Garden is a permaculture garden located at the Organic Farm. This is the direct outlet for the campus group Developing Ecological Agricultural Practices. Their interests and values are closely aligned with that of the forest gardens in housing. The primary differences are that the Housing forest gardens are located in the residential area, and that while the housing forest gardens are currently composed primarily of shade species, Demeter's Garden has a higher amount of sun and is managed more intensely as a food producing space. They will work with the Sustainability Intern to organize workshops that benefit both spaces, and will help to educate students from Sustainability Themed Housing to best care for the space. Community Gardens is a student group that provides gardening spaces to the campus community at the Organic Farm. They will provide seeds and supplies for the students to maintain the garden space.

Community groups involved include the non-profit, Terra Commons, and Thurston Conservation District. Terra Commons is a local group that installs edible forest gardens in Thurston County and other areas of western Washington. They will invite students who have opted-in to care for the garden to their workshops, and provide workshops on-site at the garden space. Thurston Conservation District has assisted with soils testing and will provide a once-yearly teach-in about soils at the site.

Appendix V

Campus Land Use Committee Project Proposal

Part of navigating the institutional process included approval from the Campus Land Use Committee to permanently alter public space on campus grounds. The following is the presented proposal.

Project Description

This project plans to develop two edible forest demonstration gardens at The Evergreen State College; one on the main campus and one on lower campus. A map indicating proposed areas is included as a separate attachment. The project will be facilitated by a graduate student and core group of students, and will work with community and campus groups that advocate sustainable food systems and community gardens. The purpose of the project is to raise awareness of our food systems, create a place for local, perennial, organic food to be grown in the campus core, and to engage students through action.

The students will collaborate with each other and with Terra Commons to develop a planting design throughout the months of January and February. They will conduct physical alteration of the site in March. The site on upper campus currently is covered with ivy. Ivy removal will be the first step, and upon removal ivy will be left to dry and die at the Lewis Road site on a sheet of plastic (to keep it from rooting), and then composted. Then, students will heavily sheet mulch the site with several layers of cardboard, followed by several inches of topsoil. The site on lower campus will be sheet mulched as well. Then the plants and drip irrigation will be installed.

Timeline

Project planning and design	December 2008 - February 2009
Site preparation and planting	March 2009

Consistency with Evergreen's Academic Mission

Evergreen's core teaching values are well-represented in this project:

Interdisciplinary study is inescapable when almost any environmental issue is addressed. Agriculture/agroecology, forest ecology, edible landscaping, community action, and environmental education are five distinct areas of learning that will be bridged, and other disciplines will likely be incorporated as needed into this complex undertaking.

Collaborative learning will be essential in this project. The planning and installation of gardens on a college campus is a task that will require shared visions and compromise, and will invite many hands.

Learning across significant differences is unavoidable when bridging gaps between students, staff, administration, and varied campus organizations. The research component of the project seeks to evaluate experiential learning not only by students, but also that of the larger campus community.

Personal engagement occurs naturally when people are involved in creation, when they are given a sense of ownership and when a space is created for interaction and community development. Also, the establishment of living things invites the cultivator to return to the roots they set into the ground, not only physically, but also metaphorically.

Linking theory with practical applications is achieved in this project as we begin with addressing the intricate issue of food security, and our end result is a young forest garden.

Suitability with Criteria for Campus Land Use
This project will connect with the Teaching Gardens that are developed in several areas of campus and are written into the Campus Master Plan. The area by Lab II is one that is covered in ivy and will be replaced with productive species. The area in Housing by the HCC receives little sunlight, and some of it is very wet, and it does not maintain conventional grass well. This plot will be planted primarily with shade loving and wet-tolerant species.

Potential Environmental Impacts
Over time (3-5 years +), these gardens will increase wildlife habitat for birds in the areas where they exist. No serious negative environmental impacts are anticipated.

Health and Safety Issues
There is potential for food-bearing plants to rot if not harvested in time. The problem will be averted through partnerships with student or community groups such as the EverGleaners, the Sustainability House, and RAD Facilities Grounds.

Ongoing Maintenance Plan
An ongoing maintenance plan is currently under development and will be one of the priorities for discussion among the student group. Maintenance should be minimal, and a specific plan will be developed as the project unfolds. A drip irrigation system is planned to minimize maintenance and watering. Possible plans include developing a partnership with a community group to do weeding and clean-up in concert with their goal of raising community awareness, working with a student group on campus, working with Sustainability House (the living/learning residential community sponsored by Residential and Dining Services), or developing a plan that works both with Facilities staff and students. RAD Facilities is committed to the long-term development of this project.

The other long-term plan we will be addressing is how the food will be used. Possibilities include incorporating into an academic program, donating to charity, and being an informal resource for the campus community.

Appendix VI

Food, Place, and Culture Course Description

The Evergreen State College offers 16-credit interdisciplinary courses. The following provides an outline of the focus of the class that participated in the edible forest gardening workshops.

Faculty: Martha Rosemeyer agricultural ecology, Zoltan Grossman geography, Native American studies
Major areas of study include: political economy, geography, food, culture, Native American and traditional food and agriculture.
Class Standing: This all-level program accepts up to 25% freshmen as well as supporting and encouraging those ready for advanced work.

Food is a central element in social exchange and definition of self and community. Perhaps even more than language, food is a marker of identity and culture. How have particular regional and national cuisines been shaped by local and global geography and history? For example, what was Italian food before the tomato's arrival from the Americas? How are local food traditions being endangered by globalization?

We will begin the quarter with an overview of the evolution of early humans and the history of food procurement, including the relatively recent development of agriculture. We will study the food gathering, cultivation practices and rights of indigenous and land-based peoples of North America and the Pacific Rim. This component will include introductory ethnobotany and field work aimed at beginning to recognize native plants of the Pacific Northwest. We will also investigate the interaction of people with their landscape through visits to local tribes and immigrant communities. Students will examine the scientific basis of various modes of traditional food preparation and preservation, including fermentation.

By focusing on a few case studies, we will dissect the notion of regional cuisine, which initially develops within the context of a distinct place with unique edible plants, animals, and spices, as well as its cultural perspectives. We will consider the Columbian Exchange, the dislocation of plants and animals following this encounter of Europe with the Americas, and its profound impact on ecological systems in both areas. We will further examine the consequences of colonialism in restructuring local food systems for the markets of Empire, and in "internationalizing" food, as in Indian curry in England. We will study how migration has changed the flavor of national identities, an example of which is how salsa has replaced ketchup as the most popular condiment in the United States.

Finally, we will look at the impact of globalization and the structure of regional economies on food, such as the effects of free-trade agreements on farmers and consumers. We will investigate how climate change is disrupting plant and animal habitats important in food procurement and cultural survival. We will consider alternative models capable of providing local food security, self-sufficiency and a stronger connection to place.

Credits: 16 per quarter
Enrollment: 48
Program is preparatory for careers and future studies in geography, culture, food, native plants and political economy.
Planning Units: Programs for Freshmen, Environmental Studies, Native American and World Indigenous Peoples' Studies, Scientific Inquiry

Appendix VII

Workshop Outline – Food Place and Culture

Part I: 1 hour classroom presentation and discussion

Presentation Outline:

i. Edible Forest Gardening Definition
ii. Purpose
    a. Population, food miles, land use, water inputs, chemicals
iii. Gardening in vs. like the forest
iv. History
    a. Tropics, Native PNW cultures, temperate climates
v. Forest Ecology Basics
    a. Vegetation Layers
    b. Vegetation Density
    c. Soils
    d. Patterning
    e. Diversity
    f. Succession
    g. Ethnobotany
vi. Gardens and Food at Evergreen
vii. Site Specific Design
viii. Desired Species
ix. Overview of Workshop
x. Continuing Opportunities

Part II: Installation Workshop

The 50-student class was broken into two groups, with one participating in the morning and the other in the afternoon. The alternate group participated in a lab workshop about plant/flower parts.

i. Site Orientation
    a. Soil
    b. Moisture
    c. Plant Identification
ii. How to Plant and Sheet Mulch: Explanation and Demonstration
iii. Students work in small groups of 2-4 in designated areas with placed plants.

Applendix VIII

Complete species list of plants in the edible forest garden. Numbers correspond with garden design map in Appendix X.

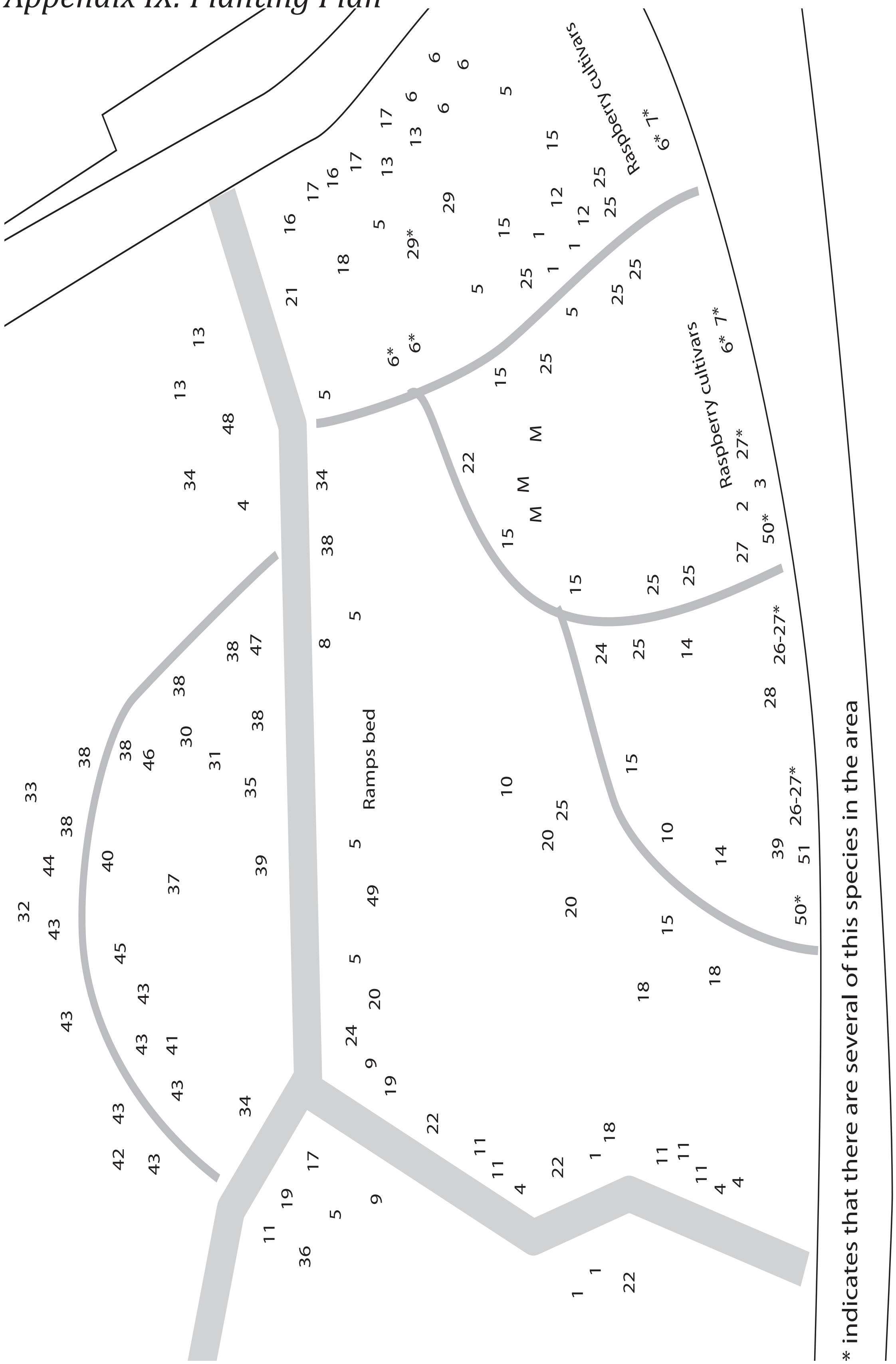
Native Species

	Genus	Species	Common Name
1	*Asarum*	*caudatum*	Wild Ginger
2	*Brodiaea*	*coronaria*	Harvest Brodieae
50	*Camassia*	*quamash*	Camas
3	*Campanula*	*Rotundifolia*	Harebell
4	*Cornus*	*canadensis*	Bunchberry
5	*Corylus*	*cornuta*	Beaked Hazelnut
6	*Fragaria*	*virginiana*	Wild Strawberry
7	*Fragaria*	*vesca*	Woodland Strawberry
8	*Gaultheria*	*shallon*	Salal
9	*Heracleum*	*maximum*	Cow parsnip
51	*Lilium*	*columbianum*	Tiger Lily
49	*Mahonia*	*aquifolium*	Tall Oregon Grape
10	*Malus*	*fusca*	Oregon Crabapple
11	*Oxalis*	*oregona*	Redwood Sorrel
12	*Ribes*	*lacustre*	Swamp Gooseberry
13	*Ribes*	*sanguineum*	Red Flowering Currant
14	*Rosa*	*nutkana*	Nootka Rose
15	*Rubus*	*spectabilis*	Salmonberry
16	*Rubus*	*parviflorus*	Thimbleberry
17	*Rubus*	*leucodermis*	Black-cap Raspberry
18	*Sambucus*	*racemosa*	Red Elderberry
19	*Scutellaria*	*lateriflora*	Blue Skullcap
20	*Urtica*	*dioica*	Stinging Nettle
21	*Vaccinium*	*parvifolium*	Red Huckelberry
22	*Vaccinium*	*ovatum*	Evergreen Huckleberry
23	*Vaccinium*	*membranaceum*	Thin-leaf Huckleberry
24	*Valeriana*	*sitchensis*	Sitka Valerian
25	*Viburnum*	*opulus*	American Cranberry
26	*Viola*	*sempervirens*	Evergreen Violet
27	*Viola*	*adunca*	Early Blue Violet

Cultivated Species

	Genus	Species	Common Name
28	*Actinidia*	*purpurea*	Ken's Red Kiwi
29	*Actinidia*	*arguta*	Meyer's Hardy Kiwi
30	*Akebia*	*quinata*	Purple Rose Akebia
31	*Akebia*	*quinata*	Shiro Bana Akebia
32	*Amelanchier*	*alnifolia*	Smokey Serviceberry
33	*Amelanchier*	*alnifolia*	Regent Serviceberry
34	*Aronia*	*melanocarpa*	Iriquois Beauty Aronia
35	*Camellia*	*sinensis*	Sochi Tea
36	*Elaeagnus*	*multiflora*	Sweet Scarlet Goumi
37	*Gaultheria*	*procumbens*	Wintergreen
38	*Gunnera*	*tinctoria*	Gunnera
39	*Ribes*	*oxyacanthoides*	Jahn's Prairie Gooseberry
40	*Ribes*	*rubrum*	Rovada Red Currant
41	*Ribes*	*sativum*	White Imperial Currant
42	*Ribes*	*uva-crispa*	Invicta Gooseberry
43	*Rubus*	*calycinoides*	Emerald Carpet Raspberry
44	*Sambucus*	*canadensis*	Nova Elderberry
45	*Sambucus*	*nigra*	Thundercloud Elderberry
46	*Sambucus*	*nigra*	John Elderberry
47	*Vaccinium*	*angustifolium*	Burgandy Low Bush
48	*Vaccinium*	*corymbosum*	Chandler

Appendix IX: Planting Plan



Applendix VIII

Maintenance Manual

This document was created as a working document to be provided to future caretakers of the garden. It outlines the vision in which the space was created, discusses a planting plan, suggests seasonal strategies to care for a perennial garden, and designates responsibilities to different groups. It also includes a list of community group partnerships and resources.

EDIBLE FOREST GARDEN by the HOUSING COMMUNITY CENTER: A MAINTENANCE MANUAL

Updated: September 2009

TABLE OF CONTENTS

VISION

We want a forest garden because…

…It will foster a deeper connection to "place"

…It will encourage interaction between people and their surrounding environment.

…It will help build community: specifically, the community of students living in nearby housing, but also the wider community of Evergreen and anyone who is interested in a more ecologically-harmonious way of life.

…It will heal the land!!!

…It will be a rich and diverse area of food-bearing species (of roots, shoots, greens, nuts, fruits, and mushrooms) demonstrating a new and different method of landscaping, providing solace, enhancing wildlife habitat

…It will offer a variety of local, sustainably-grown food and other ethnobotanical products for students.

…It will provide the opportunity to learn about forest ecology, ethnobotany, food systems, and perennial food sources.

…It will give lower campus a place to provide wildlife habitat as well as a place for students to enjoy, relax, and tend to.

…It will be an accessible place for students to actively take part in creating their community.

…It will add aesthetic beauty to the area.

…It will continue to be cared for and appreciated, and evolve over time.

We envision…

…A multilayered, interconnected web of plant species

…The opportunity to provide multi-functionality by un-developing an area that currently does not serve much purpose

…an increased array of outdoor social spaces through the creation of outdoor rooms and the opportunity for students to learn about tending land through tending them

Goals for this garden will be achieved if…

…the garden matures and is sustained over time

…students enjoy the space

…students and the community learn about perennial gardens and food systems

…we see an increase in bird abundance and diversity

...the community is able to use the things the garden produces

…there is broad participation in the creation and care for the garden.

PLAN

Species Selection

Use of native and cultivated species. Because most resources are native and because the site is wet and shady, incorporating a high degree of native species will be a primary focus. Native species will thrive as they have co-evolved with the existing landscape. Many also produce edible and medicinal products that are important and often forgotten. The exquisite flavor of salmonberries and thimbleberries is not found in stores amidst strawberries shipped from California. Concurrently we will explore cultivated species that have the potential to grow well under the site conditions that are available from regional nurseries. We will search for exotics which will best fill niches and are high yielding and provide desirable and unique food products.

Site adaptation. Species were chosen to adapt to the site rather than amending the site to allow for desired species. No major earthwork will be conducted; if trees are removed it will be in accordance with selective harvesting and cutting. We will be amending the soil on the site with woodchips, topsoil, and compost, and have drip irrigation installed for summer drought watering.

Desired crops and uses

Types of foods. fruits, nuts, berries, shoots, leaves, herbs, flowers, mushrooms. There are many native berry plants that will do well so it will have an emphasis on berries.

Amount of processing. Most berries are accessible by all to be eaten during a walk through the garden. However, some foods (including berries, i.e. elderberry) produced will require processing in order to acquire a favorable flavor, or in some cases, to be edible.

Time of Harvest. The species in the garden will have the ability to produce some sort of edible products between March and November.

Landscape Patterns

Site Description. The site is primarily a shady forest landscape. The southern areas and areas by the trail appear to stay waterlogged longer than other areas. There is patchy southern sun nearest the walkway, and less canopy cover on the northern edge. The soils on the south end appear to be deeper and more conducive to planting, but are acidic and lack nitrogen. The soils on the north end appear to be more compact and composed of clay, but more closely resemble garden soil chemistry. (see soil tests).

Suggested Design Patterns - Site Patterns. Site repair (5), Outdoor Living Room (6), Water Use Zones (8). (see Jacke and Toensmeier 2005)

Suggested Design Patterns - Garden Patterns. Mature forest gardens (15), Gaps and Clearings (16 – minimally: mainly on northern and southern edge), Forest Gardens in the Woods (17 – primarily, due to existence of current trees), Forest Edges (20 – mainly by path, soccer field create edge habitat). (see Jacke and Toensmeier 2005)

CHALLENGES

Long Term Site Issues.
Transience: The space is in use year round but it is not a year-round residence for any particular group. There will be a challenge to create a sense of continuity within a system that is transitional. Since the space is not occupied during the summer by as high a density of students, and some plants mature at that time, summer harvesting is something to bear in mind as well.
Vandalism: Because this is a public space with over 1,000 bodies moving through and around it each day, there is potential for vandalism, both intentional and accidental.
Communication. Telling the story of the site and why it exists will help to deter intentional destruction. Consequences for acts of defacement around campus should help to deter would-be vandals. Established paths and maturation of plants should minimize unintended trampling.

DESIGNATION OF RESPONSIBILITIES

To address transience in the student body, while concurrently encouraging them to be engaged with the space, the care of the garden will have responsibilities fall into the hands of multiple entities.

Residential and Dining Services Sustainability Coordinator
This position can be as involved as it chooses to in facilitating workshops, educational tours, and integrating the space into other campus curriculum. At minimum, this position is responsible for:

- ✧ Establishing and maintaining contact with all other involved parties to provide oversight, maintaining and furthering institutional memory through a record of documentation.
- ✧ Updating the website with new student work and other resources and information.
- ✧ Reporting to RAD professional staff regarding problems, successes, and opportunities.

Residential and Dining Services Grounds Crew
These student workers are in charge of garden maintenance and ensuring that the plants continue to thrive. The Grounds Crew is a vital part of making this a successful project because they will be integrating with the space on a regular basis as a part of their job duties. The Grounds Crew Lead will be in communication with the Sustainability Coordinator to align goals and plan for short and long-term changes. Primary responsibilities include:

- ✧ Install and maintain drip irrigation system
- ✧ Ensure that the plants get adequate moisture in the summer during the first 3-5 years.
- ✧ Remove the drip system if desired afterwards
- ✧ Remove weeds and invasive species
- ✧ Create and maintain paths as needed
- ✧ Cut back dead material in the fall as needed
- ✧ Pruning of trees, shrubs
- ✧ Annual sheet mulching in first few years to build soil structure
- ✧ Optional activities as outlined in student projects below

Sustainability Housing, Sustainability Housing RA, and other residents
This is an interactive garden with numerous opportunities for education, engagement, enjoyment. Students can do independent work or tie the garden into other coursework. The Sustainability Intern will develop structure for residents to opt-in to a garden program. Harvesting more sensitive species (camas and other root crops, young shoots, and less abundant plants) should take place in a coordinated effort grounded in an understanding of how this will affect the health of the site. Suggested activities for student participation include:

- ✧ Weeding non-desired species
- ✧ Sheet-mulching
- ✧ Harvesting berries, nuts
- ✧ Cooking or recipe demonstration workshops
- ✧ "Putting the garden to bed" work days
- ✧ Building benches
- ✧ Building trellises
- ✧ Mushroom Inoculation
- ✧ Planting additional plants
- ✧ Propagating plants from existing specimens
- ✧ Researching additional species
- ✧ Working with Demeter's Garden

Campus and Community Group Partnerships
A number of campus and community groups expressed interest in the creation of this space and are available as resources in developing it further, and for educating students in how to care for it and what it has to offer. They are all great resources and below discusses their relationship to the garden. These groups include:

- ✧ **Terra Commons**. A local non-profit that installs edible forest gardens in Thurston County and western Washington. They will provide workshops for our site and accept interns to work with them. Their website has extensive resources listed, and they also can help locate hard-to-find plants. www.oly-wa.us/Terra/
- ✧ **Thurston Conservation District.** Had our soil tests sent to the lab for us. They will do this annually for ~$50 for 3 sites. They also have some funding for outreach and education, and can come and do workshops on soil health and structure if we are interested and get this set up. It would be very interesting to track the changes in soil over the years to monitor if there are differences. www.thurstoncd.com/
- ✧ **Native Plant Salvage Project**. Donated a number of salvaged plants to our cause. They do plant salvages each year in the winter. It is a good way to begin to learn native plants, and about planting, transplanting, and growth. They probably cannot do workshops, but may be willing to donate again, especially if we have volunteers continue to work with them. www.nativeplantsalvage.org/
- ✧ **Sound Native Plants.** They are the largest native plant nursery in our area, and serve primarily restoration projects. They donated a number of plants, and we purchased some from them as well. They have the largest selection of species. www.soundnativeplants.com

- **Stellaria Nursery**. A small upstart nursery formed by recent Greener grads in 2009, Stellaria is specializing in providing native plants to retail purchasers. They do much of their own propagation, and are very interested in ethnobotanical use. We purchased plants from them too. Their prices tend to be higher than Sound Native Plants because they target a retail market, but as a young business with a good cause and ethics, they are worth supporting. They have a booth at the Farmer's Market.
- **Raintree Nursery.** Specialize in edible perennials. Have a large donation day in early June, when they clear out cold storage. We received a number of plants from them. If arranging this be sure to have the time and space to pot everything up! Great resource if you have questions about edible perennials. www.raintreenursery.com/
- **Burnt Ridge Nursery.** Specialize in edible perennials. Knowledgable resource. Have a table at the Farmer's Market, so you can pick things up and avoid shipping fees. www.burntridgenursery.com/
- **Teaching Gardens.** The edible forest garden is an addition to the established Teaching Gardens on campus that feature pollinator gardens, prairie gardens, and rooftop gardens, and more. Coordinating with them is a great opportunity to bring people from upper campus down here to learn about what we're doing.
- **Demeter's Garden.** Our 'sister' garden on campus, situated at the Organic Farm. Abides by permaculture methods, and includes annuals and perennials. Enjoys more sunny space, and can therefore grow a slightly different suite of species. Under direction of Developing Ecological Agricultural Practices (DEAP) coordinator, this next year it will be Amanda. With similar missions it will be good to coordinate work parties and work days, generate excitement by the HCC due to higher traffic, get these students also out to Demeter's garden to help it flourish. www.evergreen.edu/cell/demetersgarden
- **Organic Farm.** Great resource and knowledge base. Source for wood chips, tools (if we continue to return them clean and quickly), leaders or partners for workshops. www.evergreen.edu/cell/organicfarm
- **Community Gardens.** Will provide seeds, soil. Mods garden coordinated by Colin Bartlett, co-coordinator for Community gardens. Source for collaboration across the student body, gearing students with similar interests to the versatile spaces we offer on campus. www.evergreen.edu/cell/communitygarden

GENERAL GUIDE

A perennial garden assumes a different rhythm than an annual garden. One does not need to dig and sow seeds each year. As the garden matures, it requires less work aside from intended disturbance. As the shrubs and herbaceous perennial species establish themselves, they will take up more space, and eventually fill in the areas that are bare right now. It is easy to overplant a perennial space if one does not account correctly for these plants at their zenith. Other plants will begin to self-sow as the wind or the birds take their seed, and will begin appearing in other parts of the garden.

- ✧ **Winter: Sleeping.** In the winter all but the evergreens drop their leaves and take a break from photosynthesis. However, as early as January you can begin to see buds forming on the barren twigs, giving hope and premonition of the life that is waiting.
- ✧ **Spring: Awakening.** Here the buds break into new leaves. It is the time to harvest shoots of goatsbeard, salmonberry, and waterleaf. It is good to do an early weeding, being careful to know the weeds from the tiny young perennials that are reemerging from their sleep. The mid-late spring is a good time to sheet-mulch, because at this point just about everything has come up. Planting in early spring, March and April, is good, because there is still plentiful rain to help establish roots, and it is generally after most of the hard frosts.
- ✧ **Summer: Thriving.** As the heat moves in, things begin to flower and fruit. The berries ripen in succession: salmonberry, elderberry, strawberry, blackberry, raspberry, currant. The main thing to watch out for is things drying up, especially while young plants are attempting to establish themselves.
- ✧ **Autumn: Retreating.** With the frosts, things begin to drop their leaves and ready for the winter cold. At this point, larger fruits and nuts have developed, like kiwi, apples, and hazelnuts. Things will need to be cleaned up, dead growth cut back and composted or laid down to mulch. Fall is a good time to put new plants in the ground, so they can establish and break dormancy when spring comes without disturbance.

A Guide to Maintenance by Plant Structure

Trees require little maintenance. Some fruit trees require pruning, and a pruning guide should be referenced to do it correctly. Other pre-established trees (the maples and alders) in this site may benefit from pruning so as to allow more light into the center of the garden space. One can think about establishing a controlled succession by felling carefully chosen trees, especially if one is considering inoculating a stump.

Shrubs will require some cutting and being pruned back after they begin establishing themselves and taking over. Cutting the tops off of them will help them to bush out rather than become tall, therefore making berries more accessible. Deer browse, if not too heavy, can actually enhance shrub growth. Some shrubs grow much better and produce higher yields if they are cut way back. Check references before hacking away too hard.

Perennial herbaceous plants completely senesce at the end of the fall, and re-emerge in the spring. They can begin to grow pretty large after a few years, but do not develop any woody growth. Although they are mostly fairly hardy, when weeding in the early spring you will want to be careful not to pull them out! (However, they typically will have a more developed root structure and will not come out so easily; even so, damaging the first growth can stunt the plant for the duration of the season).
Ground covers are low growing, and some are herbaceous while others are evergreen or woody. While some of them can take some foot traffic, be careful not to trample them! Some of these may benefit, as they grow, from being transplanted to various areas of the garden to help them proliferate. Groundcovers suppress the growth of weeds, but some weeds will persist and will need to be pulled.
Vines do best if they have a trellis or some other upright structure to grow up. Some of them need to be cut back in order to fruit. For kiwis, look up specific kiwi information.

Undesired species will be removed or suppressed organically without chemical inputs. The two primary methods used will be suppression by sheet mulching, and hand pulling. Sheet mulching refers to laying down 3-4 layers of cardboard and covering this with at least 2 inches of wood chip mulch. This is preferred for large areas of weeds that need to be covered, or plants such as grass that form a large mat and whose removal would result in the loss of a good amount of soil. Hand pulling is preferable when the undesired species are in close proximity to the desired plants. It is important to be able to correctly identify the weeds as well as the desired plants, and to be careful not to pull out things that are desired.

SITE CONDITIONS

Hydrology. Much of the site is very wet throughout the rainy season. Drainage is hindered in some areas by thick clay soil that renders some areas impermeable. After heavy rains there are puddles that persist for a week or longer, and after very heavy rains areas of the site are partially flooded. In the spring the site retains moisture due to its shade. In the summer the area closest to the sidewalk is most prone to drying out.

Soil. Soil tests were performed by the Thurston Conservation District. We performed three tests: one in the alder stand in the corner nearest the smoking section, a second near the large maple on the north side of the path, and a third by the cedars on the west end of the site. Each of them had profiles that varied signficantly, with the "maple" sample having chemical qualities most resembling garden soil. There appears to be a very high clay content in the soil, and drainage is poor, particularly in the northern parts of the site and on both sides of the main path. Soil is deepest and most closely resembling a loam near the cedars.

Light availability. Due to canopy cover from alders and maples, in the late spring through early fall the center of the site is shady. The area next to the sidewalk gets the best sunlight, and plants that require part sun can survive here. Other 'edge' areas, the south side next to the HCC, the northernmost area that borders the grass and F Building, tend to have a part-shade light availability throughout some of the summer. The alder and maple trees can be pruned to allow more light into the area.

PLANT ADDITIONS

Suggestions and resources for future plant additions

The garden as it was planted was intended to be a beginning, and for the campus community to be able to engage in it as it grows, changes, and evolves into maturity. Student residents and student workers are encouraged to incorporate the garden into their learning, and to add to it. This next section outlines some additions to seek out that meet site requirements.

Additional Plant Species

These were evaluated and for whatever reason they did not make it into the site yet: either it was difficult to find a source, or they were not available during the window of time that we were doing the installation, or etc. Check 'em out!

Low Oregon Grape
Black huckleberry (have a plant sign for this one!)
Siberian Miner's lettuce
Yerba buena
Blue elderberry
Superhardy kiwi (we have two males in the Mods, one could be transplanted) (these both died)
Chinese magnolia vine (this was planted and died)
Good King Henry
Mitsuba
Osha
Sweet cicely
Fuki
Yarrow
Rosemary
Rhubarb
Jostaberry
Rosa rugosa (may be able to transplant from Mods)
Bamboos (do your research and make sure its not a spreading variety)

Check out cool cultivar varieties from Raintree Nursery or Burnt Ridge Nursery; these below are typically pretty resilient in shady, seasonally wet environments:

Currants
Gooseberries
Jostaberries
Hazelnuts
Elderberries
Cranberries
Blueberries
Blackberries
Raspberries
Serviceberries
Kiwis

Fungus

Mushrooms are a delightful addition to a forest garden! They provide a source of protein, and also help keep the soil healthy. They are particularly suited for this site because of its high moisture and shade content. Fungi Perfecti is local and a great source for bringing mushrooms into the garden.

You can incorporate fungus into the garden in multiple ways.

- ✧ **Mushroom plug spawn.** Inoculate logs with mushroom spawn that can be placed vertically throughout the garden.
- ✧ **MycoGrow.** A slurry that can be added to planting holes upon putting in the plants, or added later to the base of a plant. The mycorrhizae connects with the root system of the plant and encourages its growth. These are not edible (although non-toxic) but will greatly enhance the quality of existing and additional plants.

Some varieties we've considered and are interestsed in:

Shittakes
Morels
Reishi
Lion's Mane
Chicken of the Woods

Succession

Succession refers to the concept that ecosystems are not in a stable state environment, and that they are always prone to change. A typical forest succession model will refer to pioneer species, which come in after an area has been disturbed. Pioneer species are typically annuals, and do not require high inputs of nutrients. Indeed, many of them actually help to bring nutrients into the soil.

Species-specific Information

An excel sheet detailing specifics on included species is available. It would be useful to develop species-specific maintenance plans in the future if we have the resources.

Additional Resources

Edible Forest Gardens by Dave Jacke and Eric Toensmeier
How to Make an Edible Forest Garden by Patrick Whitefield
www.edibleforestgardens.com