THE EVERGREEN STATE COLLEGE
Campus Master Plan

VOLUME III - Appendix

EVERGREEN
THE EVERGREEN STATE COLLEGE
OLYMPIA, WASHINGTON

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INTRODUCTION

INTRODUCTION

The Evergreen State College Master Plan is a comprehensive long term plan for the facilities and campus grounds of the College. The plan establishes priorities for campus development consistent with the College's Mission, Strategic Plan and other current initiatives. The multi-volume document identifies opportunities where the College could focus resources to meet future demands on its facilities and land resources. The plan is an important part of the College's Capital Budget Request and 10-year Capital Plan that will be submitted to the Washington State Office of Financial Management.

The Master Plan is structured as follows:

Volume I – Site Specific Recommendations
Volume II – Goals and Policies for Land Use (1998 Campus Master Plan; Updated 2005)
Volume III – Appendix

Volume III contains technical information gathered during the planning process that provides a resource for future planning and supporting information for volumes I and II. Relevant technical reports prepared by the College's consultants, staff, faculty and students are included and cover a wide range of issues including carbon emissions, organic agriculture, place naming, transportation, utilities, teaching gardens, and other issues. Volume III also includes comments received from the College community during the planning process.

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THE EVERGREEN STATE COLLEGE ORGANIC FARM REPORT

(March, 2007)

This report was provided by Melissa Barker, Paul Przybylowicz, Martha Rosemeyer and Steve Scheuerell and describes long-term planning for the Organic Farm.

TESC Organic Farm—Past, Present, and Future

by (listed alphabetically)

Melissa Barker, Paul Przybylowicz, Martha Rosemeyer, & Steve Scheuerell

Executive Summary

The call for input to the TESC Master Plan inspired us to do some long-term thinking about the future of the Organic Farm. In this document, we propose deliberate and managed growth of Evergreen's Organic Farm. However, our main intent is to begin a campus-wide discussion on the future role of the Farm in Evergreen's curriculum and operations. In order to address the challenges outlined below, we will need to create a master plan for the Farm that considers a variety of potential alternatives and evaluates the possible impacts of proposed actions. As a way to help frame the discussion, we suggest a number of potential solutions and identify the planning that will need to occur before any actions are implemented.

Today, as never before, the Organic Farm is at a crossroads. The Farm—in its current location and configuration—has run into a number of challenges, which are primarily the result of increased demand for the services that the Farm supplies to the Evergreen and broader community. The demand for these services—hands-on learning experiences, composting on-campus food wastes, research space, and information requests—exceeds our present ability to provide them sustainably.

These challenges are pressing and, with future demands projected to increase, must be addressed in the near future. The sustainable solutions will determine the future direction of the Farm and its role in both the campus and local communities. Current challenges facing the Farm fall into four major categories:

- Staffing. Our current farm manager position has been temporarily increased to full-time. To address the issue of the manager working full-time but getting only ¾ salary, a permanent increase is needed.
- Faculty availability for the *Practice of Sustainable Agriculture* (PSA) program. We currently rely on half-time visitors, which has often resulted in a last-minute scramble to fill the position and places an additional burden on the farm manager, associated faculty and Deans. Student demand is high enough to support a full-time faculty member to serve the PSA program.
- Limited field space. Our current field space is about 3.5 acres. Thirty-five years of vegetable production has resulted in a high level of soil-borne diseases that limit the types of crops that can be grown. Resting these fields by rotating them into grazing pasture or other uses for several years will increase the health of our soils. The need to rotate between cropping and resting, as well as demand for field research space creates a need for additional field space.
- Cramped and limited academic facilities. The Farmhouse is too small to accommodate a two-faculty program with 50 students; this space needs to be remodeled. Adding additional student-designed and -built facilities such as a greenhouse and attached workshop space would ameliorate existing limitations to curriculum delivery and research. The compost facility is already over-burdened, and there is the potential to combine it with recycling of campus landscape trimmings.

The Farm, where sustainable agriculture has been taught for years, has the potential to grow and become a central part of the College's path towards sustainability. Involving students in all aspects of resolving the challenges outlined above would create programs that will be enormously attractive to students. There would be a myriad of opportunities for faculty and students from many different disciplines to be actively involved in all aspects of applying the tenets of sustainability to various projects at the Farm. By linking academic theory with actual hands-on implementation, our students will leave the College prepared to envision and implement positive new directions after graduation.

Introduction

The Organic Farm has a long and respected history at Evergreen. From its inception, the Farm has been a foremost a place of learning, as well as a gathering place, a symbol, and an experience for many individuals interested in agriculture, community food systems, ecological building, group dynamics, hands-on work, and a sustainable future.

This document reviews some of the history and current usage and outlines the current challenges facing the Farm. Integrated with an examination of the challenges/opportunities, we will outline our vision for the Farm that will continue to place Evergreen at the forefront of the sustainable agriculture/ community/food systems movement. **The proposals contained herein are one possible set of solutions and we present them to provide a focal point for the discussions that need to ensue, rather than as a finished blueprint to be implemented.**

Successful resolution of these challenges, combined with our dedication to full-time interdisciplinary programs, will demonstrate our uniqueness and excellence to students, academia, the State of Washington and the U.S. The enhancements and improvements outlined in this document are necessary if we hope to be the "greenest college in the west" (Don Bantz, Summer 2005). Throughout this document, we use "we" collectively to refer to the primary authors, as well as to include the voices of various farm users.

The Organic Farm and its associated programs are nationally recognized and regionally crucial.

Evergreen's agriculture offerings are among the most recognized and important programs that attract students to Evergreen, particularly out-of-state students. Currently 50% of the students in the *Ecological Agriculture (Eco Ag)* program are paying out-of-state tuition, significantly higher than the percentage of the students in general. In a recent poll, some 70% of the current *Eco Ag* class has said that they came to Evergreen specifically to study sustainable agriculture.

Our *Practice of Sustainable Agriculture* program is nationally recognized as one of the best hands-on sustainable agriculture programs in the US. Over the last few years, despite the proliferation of similar programs elsewhere, *PSA* has grown and the number of applicants has almost doubled. Students' self-evaluations indicate a high level of satisfaction with the direction of the program.

We are recognized leaders in the area of integrating the theory and practice in sustainable agriculture. In the last year, Martha Rosemeyer has been asked to speak on the interdisciplinary and experiential aspects of the program at Iowa State University, Oregon State University, and Cornell, as well as attend an invited networking conference for "shakers and movers" in US food system change. This past January Steve Scheuerell, Martha Rosemeyer, and eight students participated in the International Facilitating Sustainable Agriculture conference associated with the Ecofarm conference in Asilomar, CA. Evergreen was a visible participant:

> *"I enjoyed learning more about Evergreen's programs and certainly your school's enthusiastic contingent was a highlight of the conference. Your program projected a strong sense of coherence and student engagement."* Mark Keating, U of Kentucky faculty

The *Eco Ag* and *Practice of Sustainable Agriculture (PSA)* programs have had a lasting impact on the Puget Sound area and beyond. Our students are well represented at most farmers' markets in Western Washington and local farmers depend on our interns for labor, and in turn provide training. Other program alumnae work in county, state and federal agencies and operate small businesses such as nurseries.

The Farm is facing challenges resulting from past and current success

Over its long history, the Farm has been extraordinarily successful at inspiring a deep appreciation for and knowledge of organic agriculture. Use of the Farm has increased significantly in the recent past, beginning with the incorporation of *Ecological Agriculture* lab exercises at the farm in 2001 and hiring Melissa Barker as farm manager. The demand for the services that the Farm provides to the students, campus community, and local community has also increased during this time and we expect these trends to continue. This success has manifested a number of challenges and opportunities.

- External competition from other colleges has considerably raised the bar (see http://www.newfarm.org/features/2006/0506/wsu/sullivan.shtml for specific details, especially at the end of the article).
- Lack of full-time faculty teaching in PSA and other personnel issues are limiting utilization
- Current farm facilities are restricting pedagogical approaches

These will be outlined and discussed in the following sections. By their nature, these issues are complex and inter-related. Thus, there will be some overlap in topics in the sections below.

Building on our early success, other colleges have developed similar programs

In the 1970s and 1980s, Evergreen was one of the first colleges in America to offer academic training in sustainable agriculture and as a result, was a cutting-edge institution in the sustainable agriculture movement. The Farm and the academic programs associated with it are nationally recognized and have been for decades. The interest spawned by the success of the early sustainable agriculture programs has resulted in numerous competing programs. While Evergreen is still a leader in terms of agriculture-related curriculum, our facilities have been somewhat eclipsed by other programs throughout the country.

The reality is in the last three years, many colleges have surpassed our facilities for teaching about sustainable agriculture and food systems. For example, the University of Guelph is the first college in North America to offer an accredited undergraduate degree in organic farming. Washington State University has had their organic farming major approved for fall, 2006.

> "John Reganold, the WSU professor who has spearheaded the plan for the Organic Agriculture major says that organic agriculture appeals to many students who would not otherwise consider a degree in agriculture. Enrollment in WSU's traditional agriculture programs has dipped in the past 10 years, but Reganold says he gets "a call at least once a week from someone who wants information about the organic ag major." Many of those calls come from people living and working on the West side of the Cascades." (http://csanr.wsu.edu/Organic/TeachingFarmTukeyOrchard.htm)

WSU will be tapping our traditional student base, along with the 70 other United States colleges listed as having organic farming coursework and farm internships available to students (*New Farm* magazine's "Farming for Credit Directory" (http://www.newfarm.org/depts/student-farm/directory.shtml)).

Providing hands-on training in sustainable food production systems is a widely recognized necessity for the future of biodiversity protection and indeed civilization since 75% of the world's arable land use is dedicated to food production (crops and livestock). How we grow food is critical to goals of environmental stewardship. We need to capitalize on our unique curricular structure and facilities to continue in our role as a national leader. The creative possibilities are endless and the potential for campus and community involvement at a multitude of levels is an opportunity we must develop fully.

Current demands on the Farm are straining our abilities to manage them.

Activities on the Farm fall into two major categories—academic and operational. At some points these categories overlap and mesh well, for example in the *Practice of Sustainable Agriculture (PSA)* program, students learn academic disciplines needed for successful farm management while simultaneously working on the Farm and providing much of the necessary labor for Farm operations. Students also complete a variety of internships and individual contracts on the Farm, which can provide both operational labor and academic learning.

The management of Farm operations, along with supervision of various academic activities on the Farm, has a long and varied history. In the recent past, the Farm manager occupied both a staff and a part-time faculty position (teaching the academic portions of *PSA*). This arrangement "worked" for a number of years but also created a number of problems. With the hiring of the current Farm manager, Melissa Barker, the Farm manager position reverted back to a strictly staff position and we have been hiring visiting half-time faculty annually to teach *PSA*.

The current Farm Manager position needs to be increased to full time.

With the increased operational demands of the Farm, the Farm manager (currently a temporary full-time position) has a full-time job managing operations and overseeing student interns. A number of these operations, such as the composting and biodiesel facilities, have campus-wide importance and deserve campus-wide support. We have been surviving by exploiting our manager's dedication to the Farm and willingness to "volunteer" the extra hours needed. This is not a sustainable or equitable situation. To address this, the Farm manager position needs to be increased to full-time.

While the Farm is a natural center for community outreach to TESC students, homeowners/organic gardeners and farmers, this community need cannot be met by the current farm manager schedule. The farm manager is constantly barraged with requests for information on organic agriculture that she is unable to respond to due to lack of time. Many have proposed that we offer an extension type service, and TESC could always benefit from good community relations that would result.

Adding a full-time faculty person to PSA and increasing the farm manager to full time, would strengthen our connections with the local agricultural community, which would result in increased internships and cooperative arrangements with local farmers, WSU, and other agricultural organizations.

We need to hire a full-time faculty to teach in *Practice of Sustainable Agriculture*.

PSA is taught every year and enrollment has been limited because the visiting faculty position has been only halftime. There is clearly enough student demand for sustainable agriculture offerings to justify a full-time position. Currently, there are over 40 applicants for the 20 available PSA slots. This is partially responsible for the numerous sustainable agriculture contracts that are sponsored by other faculty (for example, in 2005 there were about 28 additional contracts). This resulted in increased demands on Melissa Barker (Farm manager) to provide contract support that the sponsoring faculty were unable to provide. A full-time faculty member teaching at the Farm also would provide an advisory presence for students outside the PSA program.

Continued staffing of this position with visiting faculty is not desirable. We have just recently had to deal with yet another "situation" that continued reliance on visitors has created—our visitor took a full-time position elsewhere, leaving us to scramble to pull together some resources and people at the last minute to attempt to meet the students' needs. This situation resulted in unanticipated demands on faculty, deans, and the Farm manager during spring break, as well as creating a great deal of stress for the students registered in the program. It has been difficult to find a half-time visitor to staff this program in the past. If we are committed to having a sustainable agriculture academic program on campus, we need to have the academic support for the program that keeps the Farm working. There is the danger of damaging our reputation in sustainable agriculture through repeated last-minute changes and staffing issues.

Working with visiting faculty also places additional demands on the Farm manager at the busiest time in the agricultural calendar to orient a new visitor. Visiting faculty cannot effectively be involved in the advance planning required for academic and practical endeavors (for example early season crops). The lack of continuity eliminates the possibilities of students participating in multi-year research projects, such as breeding new crop varieties, which would be both exciting and give context to their work. Receiving the legacy of the previous program in the form of seeds, evaluating them, and creating new ones would be exciting for the future students. Continuity in this position would also strengthen our ability to connect with the local agricultural community and regional institutions, as well as creating the possibility that PSA could expand to a two-faculty program that explored other academic disciplines while still meeting the operational needs of the Farm. These academic offerings would attract many students that are currently interning on farms in the area or enrolling in courses elsewhere.

Having a full-time PSA faculty member is integral to having the Organic Farm be one of the focal points for sustainability on campus—both in terms of learning and applied practice—and there is the potential for greater involvement and integration of the Farm in the near future. With the increasing interest in sustainability, both on campus and in society, the Organic Farm and associated academic programs have experienced a recent upsurge in student demand; all signs indicate future student demand will continue to increase. The Farm and its associated programs continue to be one of the very strong attractors for students from all over the U.S. We have the opportunity to become a regional center for organic and sustainable agriculture for small farms in western Washington. This position facilitates the opportunity to develop cutting edge models of campus food system sustainability.

The constraints of the agricultural season make the timing of this position unique. The academic calendar evolved from the seasonality of agriculture and the need to have students out of school during the summers to work on farms. Thus, there is a structural dissonance in the needs of *PSA* with the traditional academic year. This, coupled with the inability to put all the organisms on the Farm "on hold" every other year, means that *PSA* needs to be offered every year, spring through fall. This unique situation deserves considering a unique faculty arrangement, either having one faculty member serve for a number of consecutive years, such as in the Deanery, or hire a faculty member that is dedicated to the Farm and PSA similar to the Quantitative Resource and Writing Center directors.

The Farm is currently too small to be truly sustainable

In the campus Master Plan, 24 acres are dedicated to the Farm. However, much of this land is forested and the soils and topography indicate that it would be better left in forest. In its current manifestation, the Farm uses about 2 acres of cleared land to run a very successful farm program (The additional 1.5 acres are occupied by the community garden and the permaculture site for the student club, DEAP). The intensive use of the cleared areas at the Farm over the last 35 years has increased the incidence of soil-borne diseases and pests such that a rotation out of vegetable crops is crucial. Yet, growing vegetable crops is integral to student learning in the PSA program. In order to continue effectively teaching PSA, additional field space is needed to permit crop rotation.

In most traditional sustainable farming operations, long-term soil health is maintained by periodically converting fields used for vegetable production to pasture for grazing animals. This rotation between different types of farm production restores soil fertility through manure application and lowers the incidence of soil pests and diseases. In addition, there is increasing demand from *PSA* and *Ecological Agriculture* students to learn diversified farming, which includes integration of animals into the farming system. Adding field space to permit crop rotation and including animals as part of the Farm is a critical step towards sustainability. The recent hire of a large-animal veterinarian in a new health sciences faculty position expands the possibilities for additional teaching opportunities at the Farm.

Besides expanding field acreage to sustainably meet the educational goals of the PSA program, more area is needed to provide dedicated field space to meet hands-on learning objectives of other recurring academic programs such as *Eco Ag* and *Farm to Table*. For example, the *Eco Ag* program could include a number of activities to demonstrate cover cropping systems and the feasibility of winter vegetable production in the Pacific Northwest. Students from *Eco Ag* are currently planning an experiment that students in next year's *Food* Program will analyze for nutritional status. In addition to the expanding use of the Farm by agriculture programs, other TESC programs have increased their use of the farm, e.g. Peter Pessiki's *Organic Chemistry* and Frederica Bowcutt's medicinal plant courses.

Another growing demand for field space at the Farm comes from the need for student and faculty experimentation in sustainable agriculture and other areas. Currently, students and faculty members negotiate with the community garden coordinators for space in the community garden, and research temporarily occupies half of the community garden area. Research projects, such as Navazio and Rosemeyer's tomato breeding for late blight resistance have occupied 6000 square feet of farm space in 2004 and 2005, about half of the available research space, leaving little for others. Steve Scheuerell is interested in developing a research program that utilizes both the campus composting system and food production zones on the farm. Dylan Fischer is interested in creating a tree nursery for research and restoration work. In addition, there are several programs currently in the planning phase—an MES program in sustainable agriculture and community-based research projects—that would necessitate expanded acreage for research.

While it is clear that there is a need for additional field space at the Farm to meet the projected demands of current, recurring programs as well as planned future programs, the exact size, location, and extent of expansion still needs to be determined. Integrating agroforestry into Farm operations is one potential interesting direction that could be considered. Whether this proposed expansion would occur immediately adjacent to the existing fields or at another site would be decided in a planning process that includes campus-wide discussions (which could be the focus of a program in land-use planning). The balance between impacts and benefits would need to be carefully evaluated for all potential solutions to this challenge.

The available built facilities are inadequate for current and future demand

At the present time, there is a great deal of hands-on and experiential teaching occurring at the Farm. There is also an anticipated future increase in demand for the types of services and experiences that uniquely happen at the Farm. The Organic Farmhouse is the only indoor heated space available for academic use on the Farm. The size and organization of this space is better suited to small group activities (occupancy is 40); nevertheless, fifty+ students from the *Ecological Agriculture* program regularly squeeze in there. Additional teaching space at the Farm is needed to accommodate current use and provide for future opportunities.

We see this happening in several ways, which include:

- **Remodeling the Organic Farmhouse** to create a more flexible space. Expanding and reconfiguring the Farmhouse to accommodate three-faculty programs would increase its utility. A combination of teaching, gathering, and social place would maintain the Farmhouse's central role. Another possible addition could be a commercial kitchen.
- **Creating a commercial kitchen** for teaching food processing to create added-value products directly from the farm. Value-added grants are the way that the government is currently stimulating farming and food processing entrepreneurs. A cutting edge sustainable agriculture course might also offer traditional food processing (e.g. butter and cheese-making) for value-added and/or as a lab.

- **Building a laboratory/teaching facility** that will facilitate working with soil and large-group teaching activities. The lab facility could be broadly utilized by “dirty” learning activities that are critical hands-on components of botany, mycology, forest ecology, limnology, hydrology, soil and compost science, and all agricultural-related programs.

- **Building an integrated greenhouse facility** with the lab/teaching space to give our students crucial research and analysis skills, and allow hands-on activities during the winter. In addition to the tradition uses of a greenhouse, it would permit research and pilot demonstrations of innovative wastewater treatment using the outflow from the commercial kitchen.
- **Expanding the compost facility** that is currently over capacity processing about 2.5 tons of food waste per week. There are additional food wastes generated on campus that could be processed together with other organic materials from the campus including landscape trimming, wood waste and sawdust. Developing another composting site that could efficiently process a range of organic materials is necessary to work towards the goal of zero waste on campus as is recommended by the campus Sustainability Task Force and in the current draft of the campus Strategic Plan that is undergoing revision. The *Eco Ag* program is currently analyzing options for expanding composting on the campus; a report to the campus will be finished and placed on the CELL web site by June 16th.

The current lack of these facilities, especially the greenhouse, greatly impacts the types of teaching that can be done. In *Ecological Agriculture* and other classes taught by the authors, we have learned that growth chambers do not work adequately for student research. *Eco Ag* students would greatly benefit from greenhouse access for experimentation, or to start plants for research plots. Additional space to start plants for the Farm operations is also needed. Newly hired Forest Ecologist, Dylan Fischer, has stated his desire for a greenhouse and plant nursery location to propagate and grow tree seedlings for class use. Frederica Bowcutt has been requesting research greenhouse space for a number of years. In addition to greenhouse space, this would include suitable area for soil preparation, potting and other tasks.

Much of the planning, design, and construction of these facilities could be done by students in academic programs. The Sustainable Building/Eco-Design program is a natural fit to focus on some of these projects. Evening and Weekend faculty, Darryl Morgan, has expressed an interest in creating a facility at the Organic Farm where trees that are removed on any part of campus could be milled and dried. He is particularly interested in using this wood with his classes to create furniture to be used on campus—sustainability in action!

The Farm has the potential to grow and become a central part of the College’s path to sustainability.

The current demands on the Farm exceed our present ability to sustainably provide them. With future demands projected to increase, it is apparent that we must take steps now to grow in a sustainable manner. This planning has already started with the formation of the Center for Ecological Learning and Living (CELL), which includes the Organic Farm. CELL’s mission statement is “to provide students and the broader community with experiential learning opportunities that link theory to practice through the development of evolving models of sustainable agriculture practices, ecological design, and holistic living in the Pacific Northwest Bioregion.” The CELL has the potential to expand in many directions. By keeping the Farm at the center of its planning, we can create an integrated learning facility where students can get academic and practical experience with a wide range of approaches to sustainability.

Central to our vision for the Farm is the expansion of both the agricultural area and the on-site built teaching facilities.

Successful implementation of this vision will require support from the entire campus community.

The current emphasis on campus sustainability illuminates the need for strengthening the connections between the Farm and the broader campus community. Sustainable food systems are at the heart of the definition of sustainability. There is great interest on behalf of the campus food provider to utilize more food that is produced on campus. Implementation of this vision will provide opportunities for a wide

range of learning opportunities that will give our students concrete experience with sustainable development. There are endless possibilities for involving faculty from all over campus in this vision.

A few examples of possible program activities are: developing a master plan for the Farm, compiling a history/ethnography of the Farm community, creating a documentary film of the entire process, a survey of the campus community to determine the values attached to all the services from the Farm, economic modeling of Farm operations, and an examination of the pastoral aesthetic appeal combined with nature-focused art. The proposed expansion of the field space could be used as a program project where GIS skills, community surveys, forest ecology, and sustainable forestry all intersect to identify the most suitable area for expansion. Exploring water-use technologies and alternative wastewater systems could be a theme for another program.

The proposed remodel of the Organic Farmhouse and the new lab/teaching/greenhouse facility could all be designed, planned, and built using state-of-the-art green building techniques. In addition to providing the space to meet the demands on the Farm, these expansions will provide a myriad of opportunities to involve students in all aspects of the various projects.

The proposed additional buildings and remodel could be the focus of our *Sustainable Design* programs over a number of years. If funding is procured, students could actually build it. This blend of academics with hands-on experience will continue to attract students nationally. An Extended Education summer offering dedicated to a sustainable building practicum could round out the offerings. This will give our students critical experience with conceiving, designing, planning, and creating sustainable systems.

These possibilities and other exciting programs with a real-world project connection to the Farm will be enormously attractive to students throughout the U.S. and will further strengthen our reputation as a unique, dynamic and practical learning community.

Making this vision a reality

To realize the vision contained herein, we need community involvement and support at all levels, from the students to the top levels of the administration. There are many steps on the path towards integrating the Farm into a campus-wide sustainability strategy. A Master Plan for the Farm needs to be developed. A campus dialogue is urgently needed to discuss the need to dedicate existing open space or clear more land to meet the agricultural and food systems educational needs of our students.

With both grassroots support and administrative commitment, we can create new learning opportunities that will both challenge and sustain us for the foreseeable future. Solid support from the administration to make this vision a reality would attract and permit faculty to commit to making these projects a central part of their teaching. In addition, non-traditional funding opportunities outside of legislative appropriations, such as foundation support, should be explored to fund infrastructure improvements (again, this could be part of a program).

This document is the first step along what could be a long path. The world values what we propose to do, and there are donors willing to help make this vision a reality. Lets walk our talk and invest in the people and facilities that can make this vision a reality!

"It [the Organic Farm] is a special place and its impact on students that pass through is irreplaceable."
–Tom Gilbert, who as a student, started the compost facility.

C

TERRASCOPE REPORT

(October, 2007)

Proposal for Interdisciplinary Terrascope Education Center
The Evergreen State College
Input to Draft Master Plan October 7, 2007

OVERVIEW

We propose an interdisciplinary, multiuse facility that will bring together the disciplines of science and the visual arts and that will enable students, faculty, and outside community members to investigate and understand our campus wildlands in ways that do not currently exist. Traditionally, Evergreen has striven to bring together seemingly different elements to understand the world: the disciplines of art and science; terrestrial and aquatic habitats; and humans and nature. The "Terrascope" (literally, a structure with which to see the world") will augment the curricular needs of our environmental studies, visual arts, and creative writing programs. It will provide classroom, laboratory, and studio space surrounded by forest and other natural habitats. This structure will also provide access to the forest canopy in safe and non-destructive ways.

RATIONALE AND STATEMENT OF NEED

We recognize that any new facilities must primarily fulfill curricular needs. Provision of space and facilities to meet research and creative work are important, but secondary.

In the mission statement of the Environmental Studies Planning Unit, the three main curricular foci are: a) Human Communities and the Environment; b) Natural History; and c) Environmental Sciences. These foci are manifested through our use of our 1000 acre campus and field trips. The geographic size and protected status of the TESC campus and its location at the interface of diverse social communities and natural habitats of the Pacific Northwest make it physically appropriate for these curricular foci. Our hands-on approach to environmental studies fills a niche within the Washington State system of higher education, and one that has drawn and continues to draw a large and growing number of students to the College.

In the mission statement of the Environmental Studies Planning Unit, the three main curricular foci are: a) Human Communities and the Environment, b) Natural History, and c) Environmental Sciences. These foci are manifested through our use of our 1000-acre campus and field trips to other habitats and regions. The geographic size and protected status of the TESC campus and its location at the interface of diverse social communities and natural habitats of the Pacific Northwest make it physically appropriate for these curricular foci. Our hands-on approach to environmental studies fills a niche within the Washington State system of higher education, and one that has drawn and
continues to draw a large number of students to the College.

[add analogous paragraph from Visual Arts Planning Area here]

We observe with concern the growing impacts of humans on the natural world. As cities and suburbs grow, more and more people are now affecting wild and rural areas. This increasing proximity is a major source of the severe environmental problems that humans face. Part of the solution is to provide the next generation with the tools to foster a passion and understanding for the natural world through direct experience with it. Our students are eager to learn techniques of field studies in the wide variety of marine, freshwater, terrestrial, and celestial habitats our campus encompasses. Although TESC supports some tools and facilities (e.g., GPS equipment, Organic Farm), we lack certain facilities that would bring our students and faculty in more direct contact with the natural world in our own surroundings.

To carry out its mission, the college relies on facilities typical of college campuses: classrooms, science laboratories, computer centers, the library. Another major facility used by the Environmental Studies Planning Unit, but not officially recognized as such, is the campus itself: the set of habitats, ecological processes, geographic features, land use histories, and community connections that comprise the 1000 acres. The proposed facilities has as its centerpiece the campus itself, not as undeveloped land being used opportunistically for field studies, but as a facility as substantial and valued as a library or science laboratory.

The campus is quickly becoming a habitat island surrounded by suburban development. Increasingly such enclaves are being viewed positively by expanding communities, and are likely to become more and more common. The proposed facility will create a connection between our un-built lands and the built suburbs in a way that is minimally disruptive to the un-built lands. It could become a center for research on the role of such reserves in biodiversity maintenance, ecological changes that accompany insularization, and the kinds of ecosystem services that suburban reserves provide. It could also provide training in reserve management and similar efforts n other communities. We anticipate that the facilities we describe will support the following uses:

- Support of other existing academic programs (e.g., core programs, Introduction to Environmental Studies, Botany, Ecological Agriculture, Entomology, Herpetology, Hydrology, Mammalogy, Marine Environments, Temperate Rainforests);
- A new program offered regularly that addresses the ecological and social features of a south Puget Sound suburban reserve;
- Student/Faculty research projects;
- Community and professional outreach

[need to add Visual Arts and Creative Writing curriculum]

HISTORY

In 1999, a number of faculty from the Environmental Studies Planning Unit proposed creating the Evergreen Environmental Field Laboratory (EEFL), a laboratory to investigate the relationship between the urbanizing society of south Puget Sound and the natural components of the local landscape. It comprised a number of facilities that were conceptually linked to facilitate teaching and learning by our students, faculty, and outside community members about our campus lands. A number of structures were proposed, several of which have already come into being (natural history collection space, trail system, teaching gardens). Other structures are yet to be built.

USAGE

The structures we anticipate are innovative and will serve multiple disciplines. Environmental Studies programs and projects will use the new classroom and wet lab space. Expressive/visual Arts programs and projects will use the new classroom and studio space. All of those plus creative writing programs will use the classroom and seminar spaces. All of those plus other planning units will use the canopy walkway. The general campus and outside community members will also use the Walkway and Canopy Education Center.

We anticipate that this will meet the curricular and creative work needs of Expressive Arts.

STRUCTURE COMPONENTS:

Components of the structure include the following:

1) **One large classroom teaching space** for teaching ecological labs, with a “dirty space” for storing boots and outer clothing; plant dryers; large sinks and shelf storage space along the walls; capacity of 50 students and two faculty;

2) **One wet lab with marine and freshwater tanks** for observing and experimenting with marine and aquatic organisms;

3) **One large art studio space** for teaching nature drawing, with “dirty space” for storing boots and outdoor clothes; large sinks, and shelf storage space; capacity of 50 students and two faculty;

4) **Three breakout/seminar/critique rooms** with smooth walls for hanging artwork, and use for seminars; capacity of 25 students and one faculty;

5) **Connection paths and a staging area to an ADA accessible Forest Canopy Walkway/suspension bride**. The latter will span a deep ravine that will provide access to the treetops of the forest below the bridge. The staging area, a covered space adjacent to the proposed building, will serve as a place for orientation/education about the canopy and the ecological functions of canopy biota for students and visitors. This will encompass the structure described in the Draft Master Plan, the “Forest Observation Walk Facility”, an education center that will “provide the opportunity to study and monitor an area of the evolving tree canopy on the campus” That was envisioned as “minimal shelter…to support interpretive materials and be

carefully integrated into its site to minimize the impact of the project from both a visual and environmental standpoint" [p. 54, draft Master Plan].

6) **Caretakers' residence** to enhance security and safety of the facility, parallel to the caretaker's residence at the Organic Farm.

LOCATION AND LOGISTICS:

We envision that these structures will be sited at the end of Marine Drive, where there is an existing area of disturbed forest/ open area, at the elbow of the road.

The total square footage of the building is anticipated as between 12,000-16,000 square feet; the walkway will be 400 linear feet; the Walkway Staging area will be 700 square feet. An engineering component will be piping water from the Puget sound for the marine lab tanks.

COMMUNITY RELATIONS

Because of the location (at the edge of campus) and the exciting education/outreach potential of the structures (particularly the Canopy Walkway), we will need to develop mechanisms that allow inclusiveness of outside community members without disrupting curricular activities. We anticipate that these structures and offerings will be an important component to enhance Evergreen/community relationships as human population density increases in the lands that surround Evergreen.

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D

MECHANICAL SYSTEMS

(July, 2007)

MECHANICAL SYSTEMS – GENERAL OVERVIEW

EXISTING CONDITIONS

This section summarizes existing mechanical systems, including observed or reported operation issues, and a condition assessment based on a non-invasive field visual survey. This evaluation of the mechanical systems is based on field notes and a review of documents and drawings made available for this assessment.

GENERAL

The Evergreen State College was constructed in the early 1970s. It has a main Central Utility Plant (CUP) that provides steam and chilled water to the campus for heating, cooling and domestic hot water through an underground tunnel system. The tunnel system connects directly to mechanical rooms in the Communications Laboratory (Comm Lab), Seminar I (Sem I), Seminar II (Sem II), College Recreation Center (CRC), College Activities Building (CAB), Library, Lecture Halls Building, Science Lab I (Lab I) and Science Lab II (Lab II). A crawlspace tunnel to Housing Buildings A, B, C & D provides steam to those buildings. A direct bury branch from that tunnel provides steam to the Community Center and Housing Units E through U. Additional direct bury piping (steam and chilled water) runs from the main tunnels to the Longhouse and Lab Annex buildings. The Modular Housing Buildings are heated by electric baseboard and have no connection to the CUP. The Childcare Center has it’s own gas-fired hot water boiler, but is not connected to the CUP. Additional outbuildings consist of the Farmhouse, Geoduck House and Shop Buildings. Each of these outbuildings has its own stand-alone heating system.

Each main campus building has a steam to hot water heat exchanger for building heating and a separate heat exchanger for domestic hot water. The CRC has a separate heat exchanger for pool water heating, and the CAB utilizes steam directly for kitchen purposes.

BOILER SYSTEM

The central utility plant contains three steam boilers. The two main boilers produce 35,000 lbs/hr (approx. 33,964 MBH) of steam. These boilers are designed as 250 psig boilers, but are only run at approximately 100 psig. The btu’s per lb of steam automatically drop 2-1/2 percent (at full load) by reducing the pressure that amount. The normal full load efficiency of these boilers is approximately 80%. Since these boilers are rarely run at full load, the actual efficiency is much lower than it would be at full load, in addition to the 2-1/2% loss from the pressure reduction.
There is an additional 12,000 lb/hr (11,644 MBH) boiler that runs in the summertime to produce steam for domestic hot water heating.

The main campus total heating capacity is approximately 56,000 MBH. This does not include housing heating or any (main campus and housing) domestic hot water capacity. From discussions with boiler operating personnel, it appears that only one main boiler operates at one time during the winter. The housing total heating capacity is approximately 7,700 MBH. The main campus total domestic hot water capacity is approximately 25,000 MBH. The housing total domestic hot water capacity is approximately 3,300 MBH. That equals a total capacity (or connected load) of approximately 92,000 MBH. This means the total steam production is only 37% of the connected load. Obviously the connected load is much greater than what is required to actually heat the buildings.

The existing steam system suffers from considerable leakage at all converters, valves, condensate receivers, etc., in the existing mechanical rooms and utility tunnel. A steam to hot water system suffers loss through the heat exchanger itself on the magnitude of approximately 10-20%. However, most steam systems rely on accurately receiving condensate back from the system for re-use in producing steam. Most systems have a fair amount of loss in the condensate system, both through transmission loss in the piping and as well as leakage at receivers, valves and pumps. In combination with this, most mechanical rooms have been provided with cooling, thereby using additional energy to offset the heat loss through the steam system.

The main campus currently runs the boilers on an interruptible gas service. This means that when the utility company is under peak load they may call the school to have them switch from gas to oil for their heating needs. This occurs approximately once or twice a year on average.

COOLING SYSTEM (CHILLERS AND COOLING TOWERS)

The existing Central Utility Plant (CUP) houses an existing 800-ton York centrifugal chiller and associated pump installed in 1997 and a new 1000-ton centrifugal chiller and chilled water pump installed in 2006-2007. The current total connected load is 1600 tons with no diversity. There has not been any major complaints about lack of cooling throughout the campus, however, the system does suffer from some pumping issues and lack of circulation in the most remote buildings.

PRIMARY AIR HANDLING SYSTEMS

The eleven main campus buildings each contain a main built-up air handling system (or systems) housed in indoor mechanical rooms that are provided hot water and chilled water to the coils from the main campus system. Air handlers generally have both a supply and return fan. Conditioned air is provided to the spaces through galvanized sheet metal ducts and ceiling mounted diffusers. The majority of equipment observed (not all equipment was visible) appears to be original to the age of each building, with some minor exceptions. The existing ductwork that was observed was generally insulated and in good condition. Conditioned air is provided at 55°F year round, and then heated as needed to provide the correct leaving air temperature, depending upon seasonal and space requirements.

Exhaust fans serve various spaces (mostly bathrooms and locker rooms) throughout the buildings. Most fans are located on rooftops, although some are located in ceilings or crawl spaces. The Lab I and Lab II buildings have mostly 100% Outdoor Air systems for the labs and fume hood exhaust systems located on the rooftops. There is currently only one heat recovery unit serving a lab space in Lab II. All other labs do not have heat recovery. The Lab Annex building also utilizes mostly 100% Outdoor Air systems and exhaust without heat recovery.

POOL CONDITIONING SYSTEMS

The main unit serving the pool area, a built-up air handler located in the lower mechanical room, is operating as a 100% outside air system. It currently has a heat "run-around" coil installed in its air stream. HRC-1A and HRC-1B, as well as HRC-2A thru HRC-2D were installed in the autumn of 2002. This run-around loop is capable of capturing nearly 900 mbh of heating value. The coil currently located in the outside air intake air stream, and the coil that is located in the return air stream are both functioning. The pump serving this system has a newer (high efficiency) 1.5 hp motor. All piping insulation appears to be in good condition.

At present, the exhaust air coil is located in the plenum air stream with a large amount of free/bypass area surrounding it, and much of the rigid insulation lining the plenum is no longer attached to the walls, blocking the air stream. This is substantially reducing the efficiency of the run-around loop. This condition is also allowing chlorine-laden air to be absorbed by the concrete walls.

Current drawing schedules suggest that all return air is being processed through HRC-2A thru HRC-2D. This is presently not the case, due to factors noted. Observations currently estimate only approximately 50% of this exhaust air is being processed through the coils.

The main pool filter, heater, valves and main piping are located in a room beneath the pool area. The original sand filter was a large bed style requiring the flow of a 40 HP pump. The large bed style sand filter has been converted to an open tank for skimming. In 1988 two smaller modern, closed vessel type sand filters were added to the system.
The original 40 HP motor SP-2 has been changed. In 1988 the pump was changed to a 20 HP, 925 GPM at 60Ft H.
The two new sand filters added are STARK Model S1-120, having a min surface area of 35 SF and a flow rate of 462 GPM & 13.2 GPM/SF. The flow total for the filters is 924 GPM.

PLUMBING SYSTEMS

The majority of existing plumbing fixtures appear to be original, but are in reasonably good condition. Some bathrooms appear to have been renovated, and some of the fixtures have been replaced. Many urinals have been updated to No-Water type urinals.

Drain and vent lines all appear to be cast iron and in very good condition. Domestic water piping appears to be a mix of copper and galvanized steel, with the majority of visible piping being copper. No dielectric connections were visible during our initial inspection. The majority of domestic water lines appear to be properly jacketed and insulated. There is a mix of old and new insulation visible in the tunnels. Specific tests would need to be performed to determine if any of the insulation contains asbestos or other friable material.

CONTROLS

The existing controls are a mix of pneumatic and electronic controls with some minor hand operation. There is a main DDC system on campus that is located in the CUP, with control components scattered throughout the buildings. Existing control equipment varies in condition, the majority of it is original to the buildings, but several upgrades have occurred in the last ten years. In addition, the pneumatic system suffers from considerable leakage and affects the quality of control. The building operators appear to have a reasonably good understanding of the equipment and how it should be operated, but the overall DDC System needs to be inventoried and calibrated so that all control functions and sequences are catalogued, recorded and understood.

FIRE PROTECTION SYSTEM

There is an existing wet-pipe fire protection system that serves the main campus buildings. Existing pipe is conventional black-iron, with standard response sprinkler heads. The piping and heads appeared to be in excellent condition.

RECOMMENDATIONS

The TESC campus has an excellent main infrastructure consisting of the Central Utility Plant (CUP) and main utility tunnels that connect to the 11 main campus buildings. Both the CUP and the tunnels were built to serve a campus of approximately 12,000 students. The current campus population is in the low 4,000's. It therefore makes economic and logistical sense to continue to utilize this infrastructure, as it has plenty of space for growth and change, with very little capital investment in the infrastructure itself.

The service life of the equipment varies throughout the campus. In general, the mechanical systems have been well maintained and are in good condition. Much of the existing HVAC equipment has gone beyond its expected service life, as defined by ASHRAE and technically should be replaced. Service life for the type of equipment found in these buildings is generally in the 20-25 year range. However, many pieces of equipment are still in excellent condition and have had service upgrades to extend their life. The main air handlers in the buildings are generally in good condition and should remain. These units are built-up systems and can have pieces replaced as they wear out. The piping in the tunnels appears in excellent condition as well and can be retained depending upon it's particular service. The chillers in the CUP are new or near-new and have had control and service upgrades in the recent past.

The major exception to the above observations is the boiler system. The main, large boilers have exceeded their life expectancy, and have control components that are extremely difficult to replace or maintain. However, the smaller boiler used in the summer is in excellent condition and could be retained.

The other primary factor when evaluating the equipment is efficiency. The existing heating equipment, at it's most efficient when new, was approximately 80%. This is at the peak of the heating season with the boiler running at 100% capacity. This type of boiler does not operate very well at part-load, which the majority of our heating season is comprised of. In addition, as noted in the boiler section above, these boilers are run at a lower pressure than they were designed for, further limiting their efficiency. The inefficiencies of the steam system were also previously outlined. Nearly all of the existing air handlers currently have hot water coils, as the steam is converted at each building to hot water for heating purposes. Converting the existing steam to hot water system to an all hot water system, with new, more appropriately sized, high efficiency boilers with modern controls located in the CUP would greatly improve the overall energy efficiency of the building heating systems.

Concurrently, conversion of the domestic hot water system from central plant to distributed, point of use type hot water heaters will also greatly improve the efficiency of this campus system. This type of system could also be tied into rooftop solar thermal systems on each building that could provide some or all of the domestic hot water heating needs. The exception would be the CRC and CAB, which have high domestic hot water loads. Further investigation would be required to determine what would be the most efficient domestic hot water system replacement for those particular buildings.

The chillers and chilled water piping appears to be in very good condition, and well insulated. This system also appears to be adequately sized, and does not suffer from gross inefficiencies. Some savings can be seen through certain control and piping revisions that have been identified in previous studies.

The existing controls are in generally good condition and can adequately control the majority of the campus systems. However, a more thorough evaluation of the controls would be necessary to fully determine what measures would be required in order to maximize the efficiency of the current mechanical systems.

Most plumbing fixtures could be retained, but with new faucets and flush valves. Some fixtures would need to be replaced due to age, lack of ADA units and inefficiency. If bathrooms are to be re-configured or updated, we recommend replacing all plumbing fixtures with more water efficient units. Existing domestic water piping would need to be further evaluated. It is most likely though, that the majority of water pipe is copper pipe and does not need replacement in the near future.

The fire protection system will most likely only need revisions to accommodate any new space configuration. Existing heads would need to be replaced with fast action heads. The buildings would need to be evaluated to determine if there are any areas that are currently not sprinklered that need to be under today's code, such as in ceiling plenums and tunnels. These areas would most likely need to be fully sprinklered and could occur on a building-by-building basis.

SUSTAINABILITY

Many of the sustainability goals for the campus, such as improved envelope and maximizing daylighting, can be achieved on a building-by-building basis. Overall campus energy goals and strategies should mainly focus on efficient delivery of building utilities from the central plant and/or campus. It was previously indicated that a more efficient heating system would greatly improve the overall campus energy use. Strategies such as the use of bio-fuels for the main heating system could be incorporated with that strategy. Domestic hot water production was also previously addressed. Overall, potable water consumption could be reduced through rainwater catchment and on-site treatment/retention.

The campus cooling system could possibly be supplemented by the use of ground-source heat pumps. Further study would be required to determine if this is a viable option.

Photovoltaics could provide some of the campus electrical needs, but are unlikely to replace the current grid-fed system due to the high cost of these types of systems. These could, however, be evaluated and possibly used on a smaller, building-by-building, or system-by-system basis.

Large-scale solar thermal systems are similar in that they make environmental sense, but currently do not make economic sense in this application.

Wind generators also do not currently make economic sense in this location. Most wind generators require average wind speeds of 12 mph and greater to achieve any sort of reasonable power generation, and the Puget Sound region has average wind speeds in the 7-9 mph range. Specific data and/or testing would be required to determine if this particular location has applicable wind speeds, but most likely it does not. However, recent advancements in low-wind-speed technology have created a new genre of wind generators that work well in the 7-9 mph range, and could provide supplementary power generation on a case-by-case basis.

The current infrastructure lends itself well to a Co-Gen or Tri-Gen type facility due to it's central location, large amount of free space and distributed network. These type of facilities generally produce heat, electricity and possibly chilled water from a single source. However, an economically and environmentally sensible fuel source (such as bio-gas, crop waste, bio-diesel, etc.) must be available for this type of system to be viable. Currently, no such source exists on this campus.

The outlying campus buildings do, however, lend themselves well to many of the above strategies. A combination strategy of PV Panels, Solar Thermal, Low Wind Speed Generators, Rainwater Catchment, and Bio-fuels could be utilized to meet most, if not all, of these small building's needs. This could occur on a demonstration type level, which could then be applied on a larger scale as the economics change due to higher energy costs from conventional energy sources, and reduced production costs of sustainable technologies.

E

POWER AND LIGHTING SYSTEMS

(June, 2007)

TESC CAMPUS POWER, LIGHTING AND LOW VOLTAGE SYSTEMS

CAMPUS PRIMARY POWER DISTRIBUTION

Campus power is provided via two 12.5kV (kilovolts) distribution feeders (F5-1C and F5-2C) from outdoor fused switches located south of the Central Utility Plant. Service is provided from Puget Sound Energy by overhead lines to the outdoor switchgear. The system was originally designed for a much larger student base. Most of the 12.5kV feeders on campus are located in cable trays that run in the utility tunnel covering most of the main campus. The cables were installed in the original 1971 campus construction. Some direct bury cables have been installed where the utility tunnel does not provide access. An example of this is the cables serving the Housing area. The 12.5kV splices to buildings are made in oil filled link boxes located in the utility tunnel. Transformation from 12.5kV to 480 volt, 3 phase power occurs within the main electrical gear rooms in most building. The majority of the buildings on campus were constructed in the early to mid 1970's. Switchgear, transformers, panel boards and building power distribution are largely untouched in these buildings.

Emergency power is provided at most buildings via emergency backup generators. In some of these building there is a mix of both code required life safety and optional emergency loads. For example in the Campus Activities Building egress lighting loads are mixed with kitchen equipment loads.

LIGHTING AND LIGHTING CONTROLS

Interior

Lighting consists of a variety of different lamp and fixture types. Many of the existing recessed lens fluorescent and recessed incandescent down lights are operational and in good shape. Most of the down lights have replaced the incandescent lamps with screw in type compact fluorescent lamps. There have been upgrades and additions in several of the buildings with newer type lighting (T8 lamps and electronic ballasts) system installed. The Seminar II and Longhouse Education and Cultural Center buildings have newer lighting technology lamps and ballasts.

Exterior lighting is provided by campus standard light poles, building mounted surface fixtures and walkway mounted recess step light type fixtures.

Lighting Control

The majority of interior lighting is controlled via wall switches only. Only a few of the buildings and areas with additions or renovations done within the past ten years have automatic controls to meet the Washington State energy code. Seminar II does have limited daylighting control for fixture with in skylight zones via daylight type photo cells. Seminar II also has a low voltage programmable lighting control relay system and occupancy sensors controls. Lecture rooms in Seminar II have Lutron Grafik Eye control systems for pre-set zone controls and interface with the room audio/visual systems.

Exterior building and campus lighting is controlled via photo cells. The exception is Seminar II which uses the low voltage programmable lighting control relay system with photo cell input for control of exterior lighting.

FIRE ALARM SYSTEMS

The campus standard is EST (Edwards System Technology) that has been installed in newer building and older buildings that have been renovated or have additions. There is a campus fire alarm communication loop in the utility tunnel that provide campus wide monitoring. Several buildings such as the Campus Activities Building have older Simplex/Autocall systems. These systems were installed before ADA requirements for audio/visual and mounting height restrictions were mandated.

ACCESS CONTROL/CCTV SYSTEMS

Access control and CCTV systems have been added to many of the buildings on campus. The access control systems are Millennium systems. CCTV camera systems have been added to cover selected entries and spaces.

CLOCK

There are two clock systems in use on campus. The original hard wired, 120 volt pulse clock system is operating in most of the original buildings. There have been problems with this system and as a result a second system is being phased in. This is the Primex wireless clock system. This uses battery operated clock with GPS receiver and transmitters for automatic time correction.

RECOMMENDATIONS FOR THE FUTURE

POWER DISTRIBUTION SYSTEM

The existing campus 12.5kV power system cables have been tested and are in good condition. System has capacity to handle the expected future growth of the campus for the next ten years.

Original switchgear and panel boards in the 1970's buildings are at or beyond their expected useable life. TESC has periodically tested and maintained this equipment. The college has experienced problems finding replacement breakers and parts for this equipment. Additionally this equipment was installed prior to AIC ratings for gear. Recommend replacing electrical distribution equipment as a part of building additions and renovations.

Part of the sustainability energy savings recommendation would be to replace existing dry type transformers (480 volt to 120/208 volt) with new energy efficient type transformers as a part of building additions or renovations.

Monitoring of the power system would provide valuable information on energy usage. Metering of loads such as large mechanical units and lighting would allow the College to identify problems with mechanical and lighting control systems to maximize energy savings.

On-site power generation such as co-generation, wind and solar are currently not cost effective. These systems are in a period of major development and in the next few years the payback period will make some or all of these systems feasible. In the mean time small scale demonstration projects are useful for educational purposes.

LIGHTING AND LIGHTING CONTROLS

Interior

Lighting in many of the buildings on campus is very inefficient and does not create a comfortable environment. The replacement of existing recessed acrylic and parabolic lens type fixtures with pendant direct/indirect fixtures with electronic ballasts and T5 type lamp would greatly reduce energy and provide a much better working environment. Newer light fixture reflectors designed around the T5 lamps allow for greater distance between fixtures and reduction in the number of fixtures and lamps. Note Puget Sound Energy does have pay back incentive programs to help offset the cost of fixture replacements.

New lamp technologies such as the development of an array of fixtures using LED lamps have potential of greater energy efficiency and reduced maintenance. Recommend that these technologies be evaluated for use in replacement or future projects.

Exterior

The campus standard area lighting pole fixtures do not meet LEED dark sky cut off requirements. Recommend replacement of these fixtures with high cut off type light distribution. Fixtures installed as part of the Seminar II project should be reviewed for use as replacement fixtures. Additionally many of the building or canopy mounted fixtures are not energy efficient. Replacement of these fixtures with lower wattage, better light distribution fixtures works with sustainability goals.

Lighting Controls

Interior

On average lighting loads are 25 to 30 percent of a building's energy consumption. More energy efficient lighting fixtures are part of the overall answer to reducing energy use, lighting controls can provide as much or more in energy reduction.

Currently much of the existing lighting on campus only have local switch controls. This means lighting in toilet rooms, classrooms and offices are generally left on for hours when the rooms are unoccupied. Providing automatic on/off controls such as occupancy sensor make sure lights are not left on. Public areas where it is not desirable to have fixtures going on and off via motion sensor such as corridors would benefit from a programmable lighting control system to automatically turn on and off the fixtures on a daily schedule.

Using natural daylighting makes the most of energy savings. Many new daylighting control systems are on the market. Typically these use photo cells to control dimming ballasts in the light fixtures. Dimming the lights is much less disrupting to users than turning on and off lamps. Dimming also give the user much greater control of lighting in a space. Savings can be as high as 50 percent.

Exterior

Photo cells currently turn on the campus exterior fixtures at dusk and off at dawn. There are many hours where the lights are on with few or no one in many of the areas. Control systems that time the fixtures to 50% at a set hour and use motion sensors to bring fixtures back up to 100% would save energy use and provide for personal safety.

F

COMMUNICATIONS AND CABLE SYSTEMS

(June, 2007)

TESC TELECOMMUNICATIONS CAMPUS CABLE DISTRIBUTION INFRASTRUCTURE

CAMPUS DISTRIBUTION

Buildings located near the core of the central campus area are served by an underground system of utility tunnels that contain cable trays used in the routing of electrical and telecommunications cables.

The tunnel system is sufficiently large enough for pedestrian traffic and small motorized carts to be driven through them to deliver tools and equipment to strategic locations. Separate cable trays for low voltage communications and primary power campus loop are provide though out the tunnel system.

Cables exit the tunnel system to reach out lying buildings and at these points the cables enter a system of direct buried underground conduits and cast concrete vaults. Examples of these buildings are the Long House, Residence Units, and the Shops.

Within this system of underground conduits plastic innerduct conduits are placed inside of larger metallic or PVC conduits to facilitate the installation of the fiber optic cables.

TELEPHONE SYSTEM

The campus' main telephone switching system (PBX) is located in the basement level B-wing of the Daniel J. Evans Library building. From this location, acting as a hub, all copper cables radiate in a star topology out to all other buildings on campus distributing telephone and other miscellaneous services to those buildings. Telephone tie lines connect the Olympia campus system to the Tacoma branch campus PBX. Qwest provides telephone service to the housing residents.

The campus' main data networking system is located in the Library A-wing of the basement level. This room is referred to as the Machine Room and all campus fiber optic cables radiate outward in a star topology to all other buildings.

Emergency 'blue' telephone stanchions are located through out the main campus that are routed back to the Police Services dispatch.

DATA/COMMUNICATION CABLING

The inter-building, or backbone, telecommunications cables used on campus are made up of large pair count, shielded, twisted pair, (STP), copper cables and fiber optic cables in three types, and coaxial cables. The first type of fiber cable is singlemode (SM) fiber; the second type is 62.5/125 micron multimode (MM) (legacy fiber cables); the third type is 50/125 micron laser optimized multimode (MM) fiber optic cable to support 10 Gbps transmission speeds between buildings.

The backbone fiber and copper cables run through the basement level of the Library until they enter the tunnel system then on to other parts of the campus.

Most buildings are area cabled with Category 5E type cables that are being upgraded to Category 6(t) as buildings are being renovated.

Many of the existing communication equipment rooms were carved out of existing closets or storage rooms. These rooms are cramped and do not provide proper clearances, HVAC systems and have no room for expansion. As buildings are being renovated (such as recent renovations to the Library) these rooms are being replaced with industry standard spaces.

Lightning protection devices are provided and grounded on both ends of the copper cables that extend beyond the tunnel system into the underground conduits. This form of protection is a requirement of the NEC, Article 800.

CABLE TELEVISION

The coaxial cable distributes CATV signals to locations throughout the campus. Located on top of the Library Building is a television satellite dish. This down-links a signal that can be inserted into the campus-wide television cable distribution system. The system also has the capacity for distribution of up to three locally originated programs.

RECOMMENDATIONS FOR THE FUTURE

Existing telecommunication equipment rooms in much of the campus are too small and should be replaced with dedicated rooms that meet ANSI/TIA/EIA standards.

Wireless LAN network system coverage has been installed to the B&C wings of Library. Currently the A wing of the Library is under renovation and wireless LAN coverage is being added. The pre-design for the CAB renovation has wireless coverage planned for this building. Recommend expansion of this system to cover exterior spaces around buildings, plaza area and all existing and new buildings.

Existing telephone exchange (PBX) equipment can not support changing to a VOIP type telephone system. Recommend reviewing the benefits of a VOIP system when time for replacement of the existing PBX's.

G

CIVIL SYSTEMS

(June, 2007)

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MEMORANDUM # 01

DATE: May 10, 2007

TO: Tim Williams, ZGF
David Grant, ZGF
Jeff Dunn, ZGF

FROM: Amalia Leighton, PE
Tom von Schrader, PE

RE: Conditions / Infrastructure & Master Plan Recommendations
The Evergreen State College Master Plan
SvR Project No. 07007

This memorandum addresses conditions of the existing campus infrastructure and recommendations for the master plan for The Evergreen State College ("Evergreen") in Olympia, Washington.

CAMPUS SUMMARY

The Evergreen Campus is located on the Cooper Point Peninsula in the Eld Inlet of Puget Sound. The campus is located on 1,008 acres of land, which remains predominately forested. The campus was initially designed for 12,000 students and currently has approximately 4,500 students. There is housing on campus; however, many students live off-campus and drive onto the campus for classes or events.

WATER AND WASTEWATER UTILITIES

With the exception of the building that currently houses Olympia Community School (located near the shoreline), the campus buildings are connected to the City of Olympia water and wastewater systems. The City of Olympia ("City") and Evergreen have agreements for these services and the City will continue to provide water and wastewater service to the campus. The Olympia Community School is currently served by a septic tank and drain field. This on-site wastewater treatment system should be evaluated to verify it is functioning properly, and is sized correctly for the school population and the soils along the shoreline bluff.

Existing wastewater and water utilities were originally designed to serve a student population of 12,000 students. Discussions with campus staff indicate that the system is in good working order.

STORMWATER MANAGEMENT

The Evergreen campus lies within four different drainage basins. Portions of the campus drain to the following creeks: Snyder Cove Creek, Green Cove Creek, Unnamed (Evergreen Faculty name: Barking Dog) Creek, and Houston Creek (see attached Figure 1).

Snyder Creek
The Snyder Creek Drainage Basin lies within the Evergreen campus property. The creek has been degraded over the last 30 years since the Core area of the campus drains into it. A majority of the campus roadways and parking areas also discharge to Snyder Creek. The campus Core is located in the upper portion of the basin, and during large storm events, high flows off the impervious surfaces can cause erosion and carry sediment downstream. Discharge from the campus is not currently monitored. In the past, the United States Geological Survey monitored Snyder Creek just upstream of the culvert and Evergreen faculty used to monitor the discharge location from the campus Core.

Snyder Creek discharges into Eld Inlet in Puget Sound. There is a culvert where Sunset Beach Drive NW crosses over Snyder Creek. This culvert is not designed to let fish pass since the invert of the inlet is only submerged during high tides.

Green Cove Creek
An eastern portion the campus drains to Green Cove Creek. This area includes the ball fields, modular housing, and portions of the perimeter road. Green Cove Creek discharges to Budd Inlet in Puget Sound.

Unnamed (Evergreen Faculty name: Barking Dog) Creek
This creek is completely contained within the campus forest Reserve. This creek is fed by groundwater through seeps in the basin.

Houston Creek
The Evergreen Campus Parkway drains into wetlands that feed into Houston Creek. Houston Creek drains into Mud Bay.

Evergreen Campus Stormwater System
Evergreen is in the process of completing a Stormwater Plan for the campus. In addition to mapping the stormwater collection and treatment system, Evergreen is verifying the connections to the system. It is uncertain if the existing Core buildings discharge into the existing stormwater pipes.

Evergreen must meet the Washington State Department of Ecology (“Ecology”) Non-Point Discharge Elimination System (NPDES) Permit as a secondary MS4 permittee. As part of the permit requirements, all new construction at Evergreen that affects more than 2,000 sf must meet current stormwater management requirements as listed in the 2005 Ecology Stormwater Management Manual for Western Washington. This includes any activities to update existing campus buildings, roadways, and classrooms. The permit and manual encourages best management practices, including low impact development elements, erosion and sediment control, and community education.

Opportunities for Low Impact Development
Evergreen is taking steps to be a sustainable campus by implementing strategies that mimic the natural hydrologic processes that occurred prior to the campus development. Evergreen is a leader in this type of stormwater management. The Seminar 2 building contains green roofs, rain gardens and bioswales that attenuate stormwater prior to entering the campus system and discharging into Snyder Creek. The library was also retrofitted with a green roof that is visible and accessible from the fourth floor. Pervious asphalt was installed at ADA parking stalls near the campus housing.

Evergreen may want to explore retrofitting the existing Core buildings to include low impact development elements. These opportunities include stormwater planters around the campus Core buildings, pervious pavements and permeable pavers for the walkways and outdoor gathering spaces, swales and bioswales along the parking areas and walkways, rain gardens at the campus housing and outlying buildings.

Campus Involvement
Students and the faculty provide maintenance, monitoring, and research resource for the campus. These elements can be applied at varying scales based on demonstration and sustainability goals of Evergreen.

MASTER PLAN RECOMMENDATIONS

As part of this master planning effort, Evergreen intends to become a “zero” carbon and “zero” waste campus by 2020. Continuing to effectively manage the infrastructure will help achieve this goal. Evergreen is actively using low impact development/green infrastructure elements around the campus and is committed to including them in future development.

In efforts to become more sustainable, we recommend Evergreen complete a functional analysis of all resources on campus and in the surrounding areas. This analysis would help to determine what natural systems are degraded and how to target resources to improve them. This functional analysis will allow Evergreen to catalog the existing ecological functions and green infrastructure connections within and around the campus. For example, Evergreen can take advantage of the existing ecological functions and green infrastructure connections of the adjacent forest preserves, the regional bike and pedestrian trail system, Puget Sound processes, and the habitat and wetland areas surrounding the campus.

Continued preservation of the adjacent Reserve and encouraging alternative modes of transportation will reduce the need for pollution generating impervious surfaces and maintain the quality of the adjacent creek basins. Any new development should limit the clearing of trees and dense vegetation to reduce the impacts of increased runoff from the campus. Low impact development should be required for all new and redeveloped facilities on campus including buildings, roadways, parking areas, and related construction activities.

Water and wastewater management will be controlled by installing low flow fixtures in campus buildings and housing, and controlling and maintaining the wastewater system to prevent inflow and infiltration into the wastewater system. In addition, using native plantings that require less irrigation or considering rainwater catchment systems to water vegetation and plants throughout the campus will also help.

If you have any questions please contact Amalia Leighton or Tom von Schrader at 206.223.0326.

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PARKING RATE COMPARISONS
(2007)

Table provided by Ross Tilghman and Central Washington University Parking Services giving regional parking rate comparisons.

Parking Rate Peer & Regional Comparison 2006-2007

Updated December 28, 2006

Regional Institutions	Annual Rate-High
U of Washington	$1,019.04
WSU Pullman	$496.00
U of Oregon	$436.00
Western Washington	$314.59
Boise State	$257.00
U of Idaho	$250.00
Eastern Washington	$210.00
U of Montana	$210.00
WSU Vancouver	$203.93
WSU Spokane	$187.88
Oregon State	$186.00
Montana State	$141.00
Central Washington	$120.00
Evergreen State College	***$120.00***
Evergreen State College	**$96.00**

Regional Institutions	Annual Rate-Mid
U of Washington	$509.52
Western Washington	$276.80
U of Oregon	$261.00
WSU Pullman	$226.00
Boise State	$218.00
U of Montana	$165.00
Eastern Washington	$160.00
WSU Vancouver	$153.43
Oregon State	$144.00
WSU Spokane	$143.35
U of Idaho	$125.00
Evergreen State College	***$120.00***
Montana State	$114.00
Central Washington	$110.00
Evergreen State College	**$96.00**

Regional Institutions	Annual Rate-Low
U of Washington	$312.00
U of Oregon	$226.00
Western Washington	$204.76
Evergreen State College	***$120.00***
Evergreen State College	**$96.00**
WSU Pullman	$95.00
WSU Spokane	$91.22
Eastern Washington	$90.00
WSU Vacouver	$85.24
Boise State	$80.00
U of Montana	$69.00
Montana State	$69.00
Central Washington	$60.00
U of Idaho	$55.00
Oregon State	$40.00

Regional Institutions	Daily Rate-High
U of Washington	$11.00
Western Washington	$9.25
WSU Pullman	$7.75
Boise State	$7.00
Eastern Washington	$5.00
Oregon State	$5.00
U of Oregon	$4.00
U of Idaho	$4.00
Central Washington	$3.00
Montana State	$2.50
U of Montana	$2.50
WSU Spokane	$2.17
WSU Vancouver	$2.00
Evergreen State College	***$2.00***
Evergreen State College	**$1.25**

Regional Institutions	Daily Rate-Mid
Western Washington	$5.55
U of Washington	$5.00
WSU Pullman	$4.25
U of Idaho	$2.00
Evergreen State College	***$2.00***
WSU Spokane	$1.63
Evergreen State College	**$1.25**
Montana State	N/A
Boise State	N/A
Eastern Washington	N/A
Central Washington	N/A
U of Montana	N/A
U of Oregon	N/A
Oregon State	N/A
WSU Vancouver	N/A

Regional Institutions	Daily Rate-Low
U of Washington	$4.25
Evergreen State College	***$2.00***
Western Washington	$1.85
Evergreen State College	**$1.25**
WSU Spokane	$1.09
WSU Pullman	$1.00
Montana State	N/A
Idaho	N/A
Boise State	N/A
Central Washington	N/A
U of Montana	N/A
U of Oregon	N/A
Oregon State	N/A
WSU Spokane	N/A
WSU Vancouver	N/A

Source: Central Washington University Parking Services
TESC information added by Ross Tilghman
Existing Rate
Proposed Rate

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TRANSPORTATION REPORT

(July,2007)

CURRENT TRANSPORTATION CHARACTERISTICS

Located approximately 5 miles from downtown Olympia, and somewhat peripheral to population centers in Thurston County, the Evergreen State College's setting poses significant challenges to creating an efficient transportation system for its students, staff and faculty. Despite this seemingly remote location, strong levels of transit use, cycling, and ridesharing occur. Such good performance indicates a strong commitment among the College's people to using alternatives to single-occupancy vehicles. This commitment provides an essential foundation for creating a more energy efficient and less polluting campus transportation system.

MODES OF TRAVEL

Table I.1 shows the mode of travel used by staff and by students for commuting to campus. This data comes from separate surveys of those two groups, the Commute Trip Reduction survey for staff (June 2005), and the Evergreen Student Experience Survey 2006 for students.

Table I.1 Current Mode of Travel

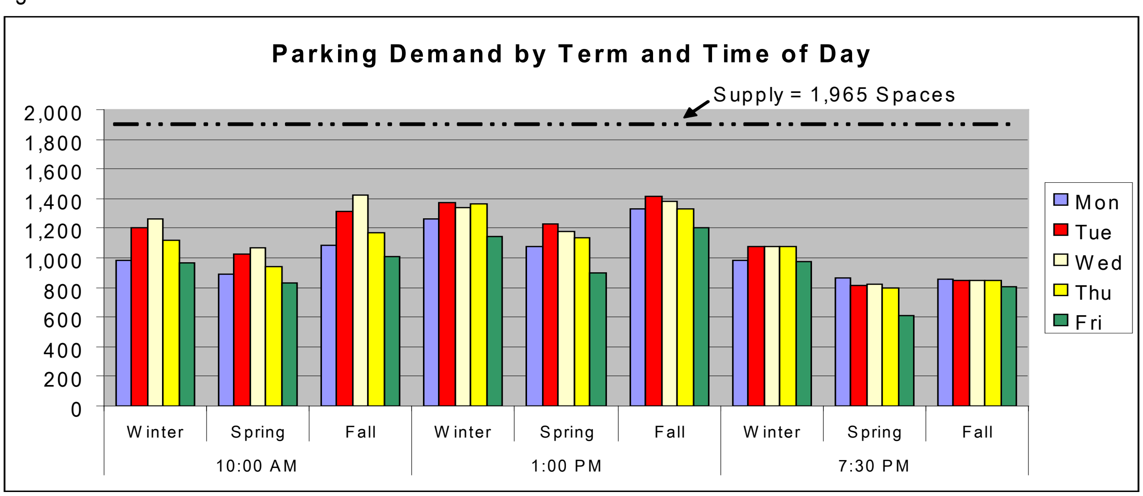
Mode of Travel	Faculty & Staff	Commuter Students
Drive Alone	66%	60%
Rideshare	16%	15%
Bus	6%	20%
Bike	10%	3%
Walk	2%	2%
Total	100%	100%

Bike use appears particularly strong among staff, while transit use is high for commuting students. Both groups have high levels of ridesharing. In fact, ridesharing rarely goes higher than these rates. Walking, not surprisingly, occurs at low rates since comparatively few people live within reasonable walking distance of campus. It should be noted that the strength of alternative modes is only minimally influenced by the very modest parking charges levied on campus.

PARKING DEMAND AND SUPPLY

Parking is monitored by Parking Services which counts the number of vehicles present each weekday at 10:00 am, 1:00 pm and 7:30 pm. Based on counts conducted from January 2006 through February 2007, the peak number of vehicles parked occurs during the fall term Figure I.1 illustrates the variations in demand across the academic year.

Figure I.1



The peak occurs in the fall quarter at 1:00 pm equally on Tuesdays and Wednesdays. At the peak, approximately 545 spaces remain vacant. Table I.2 lists the use and availability by lot.

Table I.2 Parking Occupancy by Lot at Peak Time
Fall 2006

Location	Spaces	Vehicles Parked	Spaces Available	% Occupied
Lot B	777	505	272	65%
Little B	182	33	149	18%
Lot C	557	548	9	98%
Lot F	318	272	46	86%
Fireweed Lot	23	2	21	9%
Meters	16	7	9	44%
Accessible Spaces	48	37	11	77%
Others	50	16	34	32%
	1,971	1,420	551	72%

Only Lot C achieves full use, mainly due to its closer proximity to the campus core that offers a shorter walk. The bulk of unused parking, over 400 spaces, exists in Lot B and in Small B. Lot F caters primarily to resident students. An early morning (6:30 a.m.) check of Lot F and other housing area parking spaces on three separate days in April, 2007, found an average of 234 vehicles parked, representing peak demand for resident students.

On balance, Evergreen has more than enough parking to meet most current needs. Exceptions include days when athletic fields host games for which too little parking exists near the fields for spectators, and special event days such as Super Saturday and Commencement.

Table I.3 provides the estimated composition of demand at the peak time among students, staff, faculty and visitors.

Table I.3 Estimated Composition of Peak Parking Demand at 1 P.M. during Fall Quarter

Population Group	Vehicles Parked	% of Total
Faculty/Staff/Temporary Employees	469	33%
Commuting Students	688	49%
Resident Students	235	17%
Visitors (estimated)	25	2%
Total	1,417	100%

Source: Tilghman Group

Commuting students account for the largest share of peak demand, even though they have the lowest share of auto use for access to campus. This results solely from the number of students needing to commute.

Auto availability differs widely between resident and commuting students. Based on current usage, one car is available for every 4 resident students while one car is available for every 1.5 commuter students.

PARKING RATES AND REVENUE

The amount charged to park on campus has remained stable since 2000. A rate increase has been proposed and, if approved, would take effect in the Fall quarter of the 2007/08 academic year. Rates apply commonly to all vehicles parking on campus without regard to student, staff or faculty status. Table I.4 lists current rates.

Table I.4 Current Parking Rates	
Period	**Rate**
Daily Pass	$1.25
Quarterly Permit	$32
Fall/Winter/Spring Permit	$90
Full Year Permit	$96
Meters:	
Housing Loop	$0.40 per hour
All Others	$0.30 per hour

Compared to public universities and colleges throughout the Northwest, Evergreen's parking rates fall at the lower end of all schools' rates. Even the proposed increase in rates does little to raise Evergreen's place among peer institutions. While many institutions offer tiered rates, rather than a flat rate, Evergreen consistently ranks at the bottom except for the lowest rates offered. (See Appendix H for a detailed comparison of rates among peer institutions).

Even if one purchased a daily pass every weekday of the month, it would cost no more to park than to buy a transit pass, currently $25 per month. People purchasing a $90 permit pay only $10 per month to park, substantially less than the cost of a transit pass.

Parking revenues and expenses are shown in Table I.5.

Table I.5 Parking Revenues and Expenses	
Source	**Revenue FY 2006**
Permits Sold	$165,663
Daily Revenue	$142,846
Infractions	$ 96,351
Total Revenue	$404,860
Expenses	$416,467
Net Revenue	**$ (11,607)**

The parking system does not currently take in sufficient revenue to cover its expenses. In addition, the system has outstanding debt incurred to pay for expansion and improvements in parking lots in 2004.

TRANSIT SERVICES

Two bus routes serve the campus from downtown Olympia: Route 41 and Route 48. Operated by Intercity Transit, these routes run from the downtown transit center to the campus every half-hour beginning at 6:00 am and on to 9:00 pm and then only Route 41 continues hourly until midnight. With their overlapping schedules, these two routes offer a bus every 15 minutes between campus and downtown. Due to the popular destinations served including Evergreen, Westfield Shopping Town and downtown Olympia, these are Intercity Transit's most productive routes. Table I.6 compares ridership generated by Evergreen's campus to the total route ridership.

Table I.6 Transit Ridership at Evergreen State College		
Route	Evergreeen Riders (Weekday, On + Off)	% of Total Route Ridership
Intercity Transit #41	780	32%
Intercity Transit #48	300	20%
Sum	1,080	28%

Based on Intercity Transit's passenger counts, McCann Plaza is the primary origin and destination of passenger trips, serving 70% of riders. Conversely, the Housing loop generates only 1 of every 6 campus boardings, but is used by many more disembarking riders to reach the campus Core sooner than they would by riding around to McCann Plaza (Route 41 goes first to the Housing Loop, then to McCann Plaza requiring an additional 9 minutes). It is estimated that McCann Plaza would actually serve 85% of riders if all routes went directly to it.

Evergreen students pay a fee for transit service amounting to $1.10 per credit up to 12 credits. This generates over $150,000 annually which, through a negotiated purchase, provides unlimited use passes for students to ride Intercity Transit buses. This fee amounts to roughly $0.65 per ride (when counting only those rides to and from campus), less than the regular fare of $0.75.

CYCLING & WALKING ROUTES

Dedicated multi-purpose bike and walking paths along Evergreen Parkway connect to other trails and roads linking campus to downtown Olympia and area neighborhoods. The McClane trail is the primary connection. Bicycle riders, however, face a number of gaps in the trail system and must also rely on streets without stripped paths for bikes. Gaps occur between Division Street and Evergreen Parkway, on Cooper Point Road between Walnut Rd and Evergreen Parkway, and on Harrison Street between Kaiser and Evergreen Parkway. Sidewalks lack continuity along Driftwood Rd between Overhulse Rd. and Evergreen Parkway. Trail heads for walking trails through the College's Reserve tend to be difficult to locate and would benefit from better signs. Trails serving the Reserve north of Driftwood Road lack continuity from the campus Core to their destinations.

INTERNAL CIRCULATION

The campus was carefully laid out to capture vehicles at the edges and Reserve the core areas for pedestrians. Major walkways and plazas were designed to accommodate service, security and other occasional vehicles when necessary. However, it appears that vendor, service and security vehicles routinely travel into the campus Core and are frequently present on Red Square and other plazas. While such vehicles travel slowly, avoiding serious conflicts with pedestrians and bicycle riders, their presence and their large size (frequently full-size vans) clearly diminish the walkable character of walkways and plazas that are intended to be free of large vehicles. Some maintenance personnel now use smaller electric vehicles which fit much better on paths and plazas. Opportunities to manage vehicles better on internal roads are discussed in subsequent sections.

TRANSPORTATION-RELATED CARBON EMISSIONS

With the goal of achieving zero waste and carbon neutrality by 2020, Evergreen's Sustainability Task Force has undertaken to calculate the College's carbon footprint. It estimates that transportation generates approximately 31% of the campus's total carbon emissions. This includes commuting, transit services to campus, use of the college fleet, deliveries, and long-distance air travel for college purposes. The contribution of each activity is shown in Table I.7.

Table I.7. Transportation Generated Carbon Emissions per Year		
Activity	**Metric Tons of Carbon Dioxide Equivalent (MTCDE)**	**% of Total**
Commuting	5,392	78%
College Fleet	292	4%
Deliveries	126	2%
Air Travel	1,077	16%
Transportation Total	**6,887**	**100%**

Source: John Pumilio, Sustainability Task Force

Obviously, the opportunity for the greatest reductions in carbon emissions rests with commuting.

FUTURE TRANSPORTATION NEEDS AND OPPORTUNITIES

Forecasts of transportation needs assume that enrollment will grow to 5,000 students, approximately a 10% increase over current enrollment. That growth also assumes the addition of 800 beds on campus to bring the resident student population to 1,650. Growth in faculty and staff positions is assumed to be proportional to the increase in enrollment. As discussed below, such growth can be readily accommodated by the current transportation system. Accordingly, this plan focuses less on the capacity requirements of roads and parking and more on the potential for managing transportation demand to achieve significant reductions in carbon emissions.

CHANGES IN PARKING AND TRAVEL DEMAND DUE TO ENROLLMENT GROWTH

Table I.8 presents the change in peak parking demand based on anticipated enrollment growth. The projection assumes that current transportation policies continue, and provides a point of comparison with which to judge the effectiveness of alternative policies.

Table I.8 Future Parking Demand Under Current Transportation Policies		
	Vehicles Parked at Peak Time	
	Existing	Future with 5,000 enrollment
Faculty/Staff	473	533
Commuter Students	688	656
Resident Students	235	431
Visitors	25	25
Total	**1,421**	**1,644**
Supply	1,971	1,971
Utilization at Peak	72%	83%

Campus has sufficient parking capacity to absorb the additional demand that would result from reaching enrollment of 5,000 students. Higher enrollments, however, would begin to strain parking availability unless more aggressive actions were instituted to manage parking demand.

The number of trips to campus and the change in carbon emissions from higher levels of commuting is shown in Table I.9.

Table I.9 Estimated Net Change in Travel and Carbon Emissions Under Current Transportation Policies

	Weekday Vehicle Trips	Annual Vehicle Miles of Travel	Annual Carbon Emissions (MTCDE)
Future with 5,000 Enrollment	5,200	14,342,250	5,258
Existing	5,060	13,713,465	5,027
Net Change	140	628,785	231
Percent Change	2.7%	4.4%	4.4%

Weekday vehicle trips grow only modestly with more resident students. Annual miles of travel and resulting carbon emissions grow somewhat more due to additional weekend travel from resident students.

PARKING SUPPLY ON CAMPUS

While no changes to the total amount of parking are warranted by the anticipated increase in enrollment, minor modifications to the parking supply and its allocation are suggested to meet certain needs of the campus. These modifications include:

- Improving parking near the athletic fields to serve events. A hard but still permeable surface should be installed on the Fireweed lot to control dust and erosion, and a grass parking area should be constructed on the spoils site above the Fireweed lot and adjacent to Lot C. Access to this larger grass area should be provided on event days only; it should not become a daily parking area.

- Allocating some resident student parking to the small B lot. With more student housing on campus, about 200 more resident vehicles will need parking, exceeding the capacity of Lot F which currently serves student housing. Based on the housing plans envisioned in this Master Plan, it is estimated that approximately 125 to 150 vehicles would need to be parked elsewhere on campus. The small B lot, currently underused, provides a compact and appropriately sized area to accommodate additional resident student parking. Joint use of existing facilities avoids the need to build new parking lots, retains trees, and helps to maintain a more residential character for the housing area.

MODIFICATIONS TO ROADS

Two changes are proposed:

- Closing Overhulse Place between Fireweed Lane and Driftwood Road. Closure would eliminate the road as a barrier between campus and the Reserve to the east. Owned by Evergreen State College, this road was realigned when the housing area and athletic fields were built. Overhulse Place allows a shorter route of travel between the neighborhood north of Driftwood and Evergreen Parkway, but its function is duplicated by Driftwood Road with its link to Evergreen Parkway. It carries between 1,500 and 2,000 daily vehicles, a modest volume.

- Modifying the cross-section of Driftwood west of Overhulse Road. The intent is to emphasize the local access function of this former County road, and to make it appear more a part of campus and less a perceived boundary line. Between Overhulse Road and Geoduck Lane, Driftwood would be a 22’ wide, 2-lane road. West of Geoduck Road, Driftwood would narrow to be 16 – 18 feet wide, without lane striping, but sufficient to allow low volumes of two-way traffic to use the road. Its access to Lewis Road would be limited to emergency vehicles only.

OPPORTUNITIES TO REDUCE VEHICLE USE AND CARBON EMISSIONS

While the campus can physically accommodate parking and traffic increases associated with enrollment targets, its goal to achieve carbon neutrality necessitates new measures to reduce transportation related energy use. A comprehensive, campus-wide Transportation Management Plan will be essential to realizing energy and carbon reductions. Components of the plan would include:

1. Reducing the number of autos used for commuting. Suggested targets for reducing single-occupancy vehicle are a 10% reduction in use by faculty and staff and a 20% reduction by commuting students. To do this requires:

    a. Raising the cost to park on campus. Significant increases would be needed. Experience at a variety of universities indicates that demand will drop about 1% for each 10% increase in parking price. To achieve a 10% reduction in demand would require Evergreen to raise its rates to $225 per academic year (up from $90 now for fall/winter/spring). Even at this amount, parking would cost staff no more than a transit pass. To be most effective, parking should cost more than a transit pass.

    b. Increasing transit service to reach more potential riders and simplifying routes to reduce travel time. For example, preliminary information indicates a number of staff living in the Lacey area who may benefit from direct bus service instead of transferring downtown as is currently required to reach campus. A direct route could reduce total travel time from just over 1 hour to approximately 30 minutes. Also, demand for service from areas not currently served by public transit such as Steamboat Peninsula should be investigated for appropriate types of service. One option would be for Evergreen to operate vans on key roads that could be hailed by students, staff or faculty for rides to and from campus during designated hours. Such custom van service could also provide student employment

    c. Maximizing rideshare services with ridematching for carpools and vanpools. Ridesharing already occurs at fairly high levels but it may be possible to assist more people to form a car or vanpool with targeted ride-matching.

    d. Improving bicycle access to campus. Filling in gaps in the bike trail network would increase cycling safety and convenience for more people. Important segment include completing connections to the McClain trail, and creating better connections along Mud Bay Road, Harrison, Division and Cooper Point Road.

2. Use more fuel efficient vehicles and encourage use of alternative fuels. Evergreen's drivers already use a fleet more efficient than the national average (according to findings by the Sustainability Task Force), yet additional efficiencies can be encouraged through incentives either to acquire or use vehicles with greater fuel efficiency and those that allow use of alternative fuels. A goal would be to encourage a 10% increase in efficiency.

3. Use More Efficient Fleet Vehicles. The current but limited use of smaller, electric vehicles for maintenance and security functions should be expanded to serve the majority of those trips on campus. Police vehicles could be downsized and supplemented by hybrids for off-campus trips. Greater use of bicycles and electric carts and scooters for patrols is also recommended. Smaller, quieter vehicles are also more compatible in primarily pedestrian areas such as Red Square and on main walkways.

4. Investigate central receiving and distribution for vendors' products. As with maintenance and security vehicles, too many large trucks and vans now enter pedestrian areas to deliver beverages and other goods. By consolidating truck deliveries at existing loading docks and then distributing goods using electric carts, the delivery system can better maintain a pedestrian atmosphere, reduce noise and minimize fuel consumption.

5. Shorten the distance each auto travels. Creating park and ride lots for campus commuters would reduce the number of vehicle miles traveled for each trip to and from campus. Remote lots need to be located near major travel corridors such as US 101, I-5 and major arterial streets. Potential locations for park and ride lots include the west end of Mud Bay Road near Madronna Beach Rd, the vicinity of the Westfield Shopping Town Mall, and

potentially the existing Lacey Park and Ride lot (assuming its expansion). Such locations allow a convenient point to park commuter vehicles from the west, south and east. Based on available information, it is estimated that from 925 to 1,000 remote spaces in total would be appropriate, assuming that some staff and students would still need to park on campus occasionally, as would visitors and resident students. Each location would need approximately 250 – 400 spaces (more precise figures would be determined through more detailed surveys of travel patterns). These locations would reduce daily vehicle miles of travel by about 40% (currently, commuters drive an average of 13 miles each day, and these locations would shorten the trip total by approximately 6 miles). Dedicated buses such as a double-decker bus would shuttle commuters between the remote parking lot and the campus. Buses should arrive frequently, at a minimum every 10 minutes and preferably every 5 minutes. Such buses could operate on bio-fuels or natural gas to reduce carbon and other emissions. It is estimated that 6 buses would be needed to serve three park and ride sites.

Table I.10 shows the range of emission reductions possible with the implementation of the above transportation management actions. Significant reductions could be achieved through aggressive action, but such results can only be realized through a coordinated set of policies addressing the cost of parking, the provision of convenient commuting options, and greater fuel efficiency and fuel flexibility in the vehicles used.

Table I.10 Estimated Annual Carbon Emissions (MTCDE) from Commuting to The Evergreen State College

	Existing	Future (5,000 enrollment)	Change over Existing
Current Policy	5,027	5,258	*4.6%*
Minimal Action SOV Reductions: -10% Staff; -20% Students		4,519	*-10.1%*
Moderate Action Above, plus 10% More Efficient Vehicles		4,108	*-18.3%*
Maximum Action Above, plus Park & Ride		3,540	*-29.6%*
Maximum Action – with Biodiesel		2,989	*-40.5%*

PARKING CAN HELP PAY FOR NEW TRANSPORTATION SERVICES

Increases in parking fees not only reduce parking demand but they can generate substantial new revenue to pay for additional transit services. As previously noted, the current parking system operates at a deficit considering its debt obligations. Even with the proposed 25% fee increase, revenue will only just meet the total obligation, leaving little surplus. The increase, while necessary, barely lifts parking rates to a level that would influence demand. Table I.11 presents the range of revenue that could be generated from parking rates that equal or exceed the monthly cost of a transit pass.

Table I.11 Potential Parking Revenue

Revenue	2006 Actual	2008 Projected	2008 Option A Parking Permit Equals Transit Pass Cost	2008 Option B Parking Permit Equals Transit Pass Cost + 25%
Permits Sold	$165,663	$214,000	$378,647	$ 447,709
Daily Revenue	$142,846	$237,200	$325,689	$ 485,676
Infractions	$ 96,351	$115,000	$104,000	$ 98,375
Total Revenue	$404,860	$566,200	$808,335	$1,031,760
Expenses	$416,467	$451,000	$451,000	$ 451,000
Net Revenue	**$ (11,607)**	**$115,200**	**$357,335**	**$ 580,760**
Debt Service Interest (on Deficit Balance)		$ (7,000)	$ (7,000)	$ (7,000)
Debt Service Principal & Interest		$ (72,299)	$ (72,299)	$ (72,299)
Funds Available for Other Uses		$ 35,901	$278,036	$ 501,461

Notes:

1. Higher parking rates expected to reduce demand by 5% & 15% for Options A and B, respectively.
2. Repayment of Interfund loan created an account deficit for which additional monies were borrowed accruing additional interest.

SUBSEQUENT PLANNING AND ANALYSIS

As Evergreen pursues its goals of carbon neutrality and evaluates options to meet those goals, the College will need to develop its own internal surveys to get reliable and sufficiently detailed information to plan for and monitor the effect of new transportation services. For example, it will become extremely helpful to map the residential locations of bus riders, carpoolers, bike riders and drivers to identify new service opportunities tailored to their needs. Basic patterns can be identified while protecting individual privacy and the confidentiality of personal information. Also, greater specificity can be achieved in determining the mode of travel by asking for the mode used on specific days rather than asking for the mode “typically” used.

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FLORISTIC STUDY
(2007)

This document (provided by Evergreen faculty member Federica Bowcutt), is a student report by Sam Lohmann created in 2006, indicating the plant communities that occur on campus.

A Floristic Study of The Evergreen State College Campus
Sam Lohmann
June 12, 2006

INTRODUCTION

This paper lists the vascular plants that occur on the campus of The Evergreen State College (TESC), and describes the nine principle plant communities of the campus. It is based on my field observations and collections during Spring Quarter of 2006, and also on the specimens housed in the TESC herbarium, collected by numerous workers since the mid-1970s. Pene Speaks's "The Campus of The Evergreen State College: Soils and Vegetation" (1982) was also a useful resource, and my study is partially a revision and expansion of the floristic information in that article.

I used Hitchock and Cronquist's *Flora of the Pacific Northwest* (1973) for my identifications, and follow its nomenclature, except for revised family names. The paper follows a format adapted from Bowcutt (1999).

It should be noted that this study is not exhaustive. It does not include the many cultivated plants on campus, except if they have naturalized. Although I made an effort to cover many trails and range widely and representatively over the campus, I did not have time to systematically cover the entire grounds. I did not concentrate on grasses or small weeds, and my study does not do full justice to the diversity of these groups on campus. In addition, there were some species collected on campus by other workers, whose presence I was not able to confirm in the field; this is noted in the plant list. Thus the plant list should be regarded as an introduction to the plants of the campus and a starting point for further floristic work, rather than as a complete, definitive catalog.

LOCATION AND GEOGRAPHY

The TESC campus covers 965 acres, about two thirds of which is covered by woodland and forest. It is located approximately five air-miles northwest of Olympia, Washington, and includes 1000 meters of shoreline on Eld Inlet. Its latitude and longitude are 47°4' N, 122° 58' W, and in the U. S. Geological Survey it occupies most of Township 18 N Range 2 W Section 6, as well as small portions of Township 18 N Range 2 W Section 7 and of Township 19 N Range 2 W Section 31. According to Speaks (1982), who does not give his sources, "Before purchase by the state, beginning in 1968, the campus lands were made up of residences, small farms, and undeveloped land. . . . Old growth forest was removed shortly after 1845, when Thurston County was first settled. It was logged again in the 1930's and 1940's, and parts of it again in the 1960's." The forests and woodlands on campus have been well preserved since the founding of the college.

The climate and geology of the campus are typical of the Puget Sound Area of the *Tsuga heterophylla* Zone as described in Franklin and Dyrness (1988). It is characterized by cool, wet winters and mild, dry summers, and by a geology shaped by glaciation. The specific geography and geology of the campus are well described in Speaks (1982).

FLORA

This study documents a total of 210 vascular plant species found on the TESC campus, representing 53 plant families. Of these families, Asteraceae has by far the most species (24 species), with Rosaceae (16 species) and Poaceae (14 species) coming in second and third. Although there are undoubtedly other species to be found on campus, this study represents the majority of the plant diversity there.

VEGETATION

Nine plant communities occur on the TESC campus: red alder—bigleaf maple woodland; Douglas-fir forest; western red-cedar—western hemlock forest; red alder—bigleaf maple—Douglas-fir—western red-cedar forest; salmonberry—skunk-cabbage riparian bog; Lyngby's sedge—pickleweed salt marsh; willow—hardhack riparian scrub; non-native perennial grasslands; and ruderal. Table 1 summarizes these communities according to their vegetation types.

The boundaries between plant communities tend to intergrade, although salt marsh, roadside ditch, and roadside willow—hardhack riparian bog communities tend to be rather sharply delimited by topography and hydrology. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest might be thought of as a mere intermediary state between red alder—bigleaf maple woodland and coniferous forest; however, since it is so extensive and seems to have its own particular type of community, including some species not found elsewhere, I have chosen to consider it as a distinct vegetation type.

Table 1. Vegetation types and plant communities on the TESC campus.

Vegetation types	Plant communities
Woodland	Red alder—bigleaf maple woodland
Forest	Douglas-fir forest Western red-cedar—western hemlock forest Red alder—bigleaf maple—Douglas-fir — Western red-cedar forest
Wetlands and riparian vegetation	Salmonberry—skunk-cabbage riparian bogs Lyngby's sedge—pickleweed salt marsh
Scrub	Willow—hardhack riparian scrub
Grasslands and other herbaceous vegetation	Non-native perennial grasslands Ruderal

Descriptions of each of these plant communities follow.

Red Alder—Bigleaf Maple Woodland

Alnus rubra and *Acer macrophyllum* codominate in relatively open woodlands on moist sites which have been disturbed or cleared. There is considerable diversity in the understories of these woodlands, and considerable variety among them, but they can be divided into two main types: moister areas carpeted densely by *Dicentra formosa, Hydrophyllum tenuipes, Montia sibirica* and *Rubus ursinus,* to the exclusion of shrubs; and dryer, more diverse areas with a shrub understory including *Gaultheria shallon, Holodiscus discolor, Berberis nervosa, Oemleria cerasiformis, Rubus spectabilis, Rubus parviflorus, Rosa gymnocarpa,* and *Vaccinium parvifolium,* and a sometimes sparse herb layer including *Dicentra formosa, Carex* spp., *Geum macrophyllum, Hydrophyllum tenuipes, Juncus* spp., *Montia sibirica, Polystichum munitum, Pteridium aquilinium,* and *Rubus ursinus.* Near roadsides and fields, the grasses and weeds listed above for the field vegetation type are also common. These woodlands, where they are adjacent to older forest, tend to grade into the mixed forest type described below.

Douglas-fir Forest

Large portions of the campus are covered by *Pseudotsuga menziesii* forest, in which this tree is almost totally dominant, although several other trees may occur occasionally: *Acer macrophyllum, Alnus rubra, Cornus nuttallii, Taxus brevifolia, Thuja plicata,* and *Tsuga heterophylla.* This is an early succession stage of coniferous forest; it occupies land which was logged in the 1950s and 1960s (Winn and Jackson 1975). This forest can be divided into two main types: wetter areas where the ground is more or less exclusively dominated by *Polystichum munitum,* and shrubs and other herbs are sparse (although all the species found in the dryer type of Douglas-fir Forest may occur); and the more diverse and widespread dryer areas where the ground-cover is dominated by *Gaultheria shallon.* Common shrubs are *Berberis nervosa, Holodiscus discolor, Sambucus racemosa, Vaccinium ovatum,* and *V. parvifolium. Acer circinatum, Berberis aquifolium, Rhamnus purshiana* saplings, and *Symphoricarpos albus* are occasional. *Ilex aquifolium,* an invasive tree, is also occasional but seems to be rapidly spreading, and should be controlled. Common understory species are *Athyrium filix-femina, Dicentra formosa, Osmorhiza chilensis, Polystichum munitum, Rubus ursinus, Trientalis latifolia, Trillium ovatum,* and *Viola sempervirens. Corallorhiza maculata* occurs occasionally. Where this forest borders on roads, parking lots or the main campus, it is sometimes host to invasive weeds, particularly *Geranium robertianum* and *Hedera helix.*

Western Red-Cedar—Western Hemlock Forest

The older coniferous forests on the campus, reflecting climax conditions for our floristic zone (Franklin and Dyrness 1988), are dominated by *Thuja plicata* and *Tsuga heterophylla. Pseudotsuga menziesii* is also common, while other tree species—*Acer macrophyllum, Abies grandis,* and *Taxus brevifolia*—occur occasionally. Where this type of forest borders the beach, *Arbutus menziesii, Populus trichocarpa, Rhamnus purshiana* and *Salix* spp. are also found. Common shrubs are *Berberis nervosa, Gaultheria shallon, Sambucus racemosa, Vaccinium ovatum* and *V. parvifolium. Berberis aquifolium* and saplings of *Rhamnus purshiana* are occasional. *Polystichum munitum* is a dominant ground-cover in many areas. Common understory species include *Achlys triphyllum, Athyrium filix-femina, Rubus ursinus, Maianthemum dilatatum, Smilacina racemosa,* *Trientalis latifolia, Trillium ovatum,* and *Viola sempervirens. Adiantum pedatum, Blechnum spicant,* and *Polypodium glycyrrhiza* are occasional. *Asarum caudatum, Calypso bulbosa, Chimaphila umbellata, Corallorhiza maculata,* and *Monotropa uniflora* occur rarely. This type of forest surrounds several salmonberry—skunk-cabbage riparian bog communities.

Red Alder—Bigleaf maple—Douglas-Fir—Western Red-cedar Forest

Large areas of forest on campus are codominated by *Acer macrophyllum, Alnus rubra, Pseudotsuga mensiezii,* and *Thuja plicata. Cornus nuttallii, Taxus brevifolia,* and *Tsuga heterophylla* occur occasionally. This type of forest is usually intermediary between red alder—bigleaf maple woodland and western red-cedar—western hemlock forest, but is far more extensive than the former and constitutes its own unique and extremely diverse community. Common shrubs are *Holodiscus discolor, Oemleria cerasiformis, Rubus parviflorum, R. spectabilis, Sambucus racemosa,* and *Vaccinium parvifolium. Amelanchier alnifolia, Berberis nervosa, Gaultheria shallon, Rosa gymnocarpa, Symphoricarpos albus,* and *Vaccinium ovatum* occur occasionally. Common understory are *Adenocaulon bicolor, Athyrium filix-femina, Dicentra formosa, Hydrophyllum tenuipes, Maianthemum dilatatum, Montia sibirica, Osmorhiza chilensis, Polystichum munitum, Pteridium munitum, Rubus ursinus,* and *Smilacina racemosa.* A wide variety of other herbs occur occasionally (see "Annotated Checklist of Vascular Plants," below). This type of forest surrounds several salmonberry—skunk-cabbage riparian bog communities, as described below.

Salmonberry—Skunk-cabbage Riparian Bogs

Riparian bogs occur around streams and creeks, especially near shallows where the soil is muddy rather than sandy or rocky. They are characterized by year-round standing water or mud, although the amount of moisture can vary widely. These communities are surrounded by forest, but are themselves characterized by a lack of large trees, although some plants of the bog community may permeate among nearby trees. The bog shrubs may be divided between those that prefer more sunlit areas in mixed forest—*Acer circinatum, Ribes bracteosum, Rubus spectabilis,* and *Salix sitchensis*—and those that prefer the shade of primary coniferous forest—*Oplopanax horridum* and *Sambucus racemosa.* However, all these shrubs may occur in both types of forest. Similarly, different herbs characterize these two types of bog, though all may be found in either type. In mixed forest, *Athyrium filix-femina, Cardamine angulata, Carex amplifolia, Hydrophyllum tenuipes, Lysichitum americanum, Oenanthe sarmentosa, Maianthemum dilatatum,* and *Smilacina racemosa* are common. In primary coniferous forest, *Achlys triphylla, Disporum hookeri, Polystichum munitum, Smilacina stellata, Streptopus amplexifolius, Tiarella trifoliata* and *Trientalis latifolia* are common.

Lyngby's Sedge—Pickleweed Salt Marsh

There is a small salt marsh on the beach, bordered to the south by a riparian bog community, and to the east and west by western red-cedar—western hemlock forest. It is dominated by *Carex lyngbyei,* with patches of *Grindelia integrifolia, Plantago maritima, Salicornus virginica,* and *Troglochin maritimum* along the edge. *Glaux maritima* and

Jaumea carnosa have been collected here in the past, but were not observed during the present study.

Willow—Hardhack Riparian scrub

Deep, boggy drainage ditches along the southern half of Evergreen Parkway are populated by a dense thicket codominated by *Salix lasiandra, S. scouleriana, S. sitchensis,* and *Spiraea douglasii. Rubus discolor, R. parviflorum,* and *R. spectabilis* are occasional. The ground is covered by *R. ursinus* and a variety of grasses and weeds.

Ruderal

Small, moist roadside ditches constitute their own community of grasses, weeds and herbs. All the grasses and weeds occurring in fields (see above) occur, with *Anthoxanthum odoratum, Dactylis glomerata* and *Poa palustris* being most common. The various nonnative field weeds also occur, especially *Ranunculus repens* and *Pteridium aquilinum*. However, the ditches are generally dominated by native understory species. *Dicentra formosa, Equisetum telmateia, Hydrophyllum tenuipes, Montia sibirica,* and *Rubus ursinus* are common. *Equisetum arvense,* and *Urtica dioica* are occasional, as is the nonnative *Geranium robertianum.*

Other ditches and ruderal areas are dominated by one or more of the following: *Anchusa cf. azurea, Hedera helix, Rubus discolor, R. parviflorum,* and *Symphytum officinale.*

Non-native Perennial Grasslands

There are several small fields and meadows on the campus, dominated by grasses; among the most abundant are *Anthoxanthum odoratum, Dactylis glomerata, Festuca* spp., *Holcus lanatus, Lolium multiflorum, Poa palustris,* and *P. pratensis.* A wide variety of weed associates are present, including *Bellis perennis, Capsella bursa-pastoris, Hypochaeris radicata, Myosotis* spp., *Taraxacum officinale,* and *Veronica serpyllifolia,* in frequently mowed areas. In less frequently mowed areas, *Daucus carota, Galium trifidum, G. triflorum, Plantago major, P. lanceolata, Pteridium aquilinum, Ranunculus repens*, *Rubus ursinus, Rumex acetosella,* and *Trifolium* spp. are also found. Some of these areas have been invaded by dense patches of nonnative weeds, including *Cytisus scoparius, Rubus discolor,* and *Vinca major.* Others (notably the old field on the north side of driftwood road, to the west of Parking Lot F) have given way to the succession of red alder—bigleaf maple woodland.

MANAGEMENT RECOMMENDATIONS

Although much of the forest on campus is very healthy, certain areas are threatened by invasive weeds. *Hedera helix* is the most abundant of these, forming large mats in the forest on the edges of the main campus, and also along the beach. It prevents the growth of native understory species and can damage trees. This species is so well established in some places that it will be difficult to eradicate, but an effort should be made to remove as much as possible, especially along the beach.

Other invasive species are much less well established, and could be controlled by a manual removal program. These include *Geranium robertianum* (on roadsides and along trails); *Ilex aquifolium* (occasional in all forest types); and *Cytisus scoparius* and

Rubus discolor(both in non-native perennial grasslands, roadsides, and willow-hardhack riparian scrub).

ACKNOWLEDGEMENTS

I am indebted to Frederica Bowcutt for her advice, encouragement and practical assistance to me in this project, and especially for her painstaking reading and editing of several drafts of this study. Thanks are also due to Nicole Allen and Jesse Dutton Miller for their help and advice.

ANNOTATED CHECKLIST OF THE VASCULAR PLANTS

Voucher specimens are housed in The Evergreen State College Herbarium. Nomenclature follows Hitchcock and Cronquist (1973). An asterisk (*) indicates nonnative species. An additional sign (+) indicates those unnaturalized cultivated species which happen to be vouchered in the herbarium. Some species are vouchered but were not observed in the field during the present study, and these are noted as such. Undoubtedly there are other species present on campus which have not yet been collected or identified, including several grasses.

PTEROPHYTA

POLYPODIACEAE—Common Fern Family

Adiantum pedatum L.—Maidenhair fern. Occasional. Western red-cedar—western hemlock forest. *Wiedemann 230-1, Wiedemann 230-2.*

Athyrium filix-femina (L.) Roth.—Lady-fern. Abundant. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and western red-cedar—western hemlock forest. *Peterson 231-2*

Blechnum spicant (L.) Roth.—Deer fern. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen (unnumbered).*

Polypodium glycyrrhiza D. C. Eat.—Licorice-fern. Occasional. Epiphytic on *Acer macrophyllum* in red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 134, Schwennesen 135, Peterson 233-1.*

Polystichum munitum (Kaulf.) Presl—Sword-fern. Abundant, locally dominant. Douglas-fir forest, western red-cedar—western hemlock forest, and Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 136, Schwennesen 137, Peterson 234-2, S. B. H. & R. S. 25.*

Pteridium aquilinum (L.) Kuhn. var. *pubescens* Underw.—Bracken, brake-fern. Abundant. Red alder—bigleaf maple forest and ruderal. *S. B. H. & R. S. 26.*

SPHENOPHYTA

EQUISETACEAE—Horsetail Family

Equisetum arvense L.—Common horsetail. Occasional. Wet ruderal areas and red alder––bigleaf maple woodland. *Lohmann 23.*
Equisetum telmateia Erh.—Giant horsetail. Common. Wet ruderal areas and salmonberry—skunk cabbage riparian bogs. *Lohmann 5.*

CONIFEROPHYTA

CUPRESSACEAE—Cypress Family

Thuja plicata Donn.—Western red-cedar. Abundant, locally dominant. Western red-cedar—western hemlock forest and red alder—bigleaf maple—Douglas fir—western red-cedar forest. *Schwennesen 59, S. B. H. & R. H. 3, Peterson 102-3*.

PINACEAE—Pine Family

Abies grandis (Dougl.) Forbes.—Grand fir. Rare. Western red-cedar—western hemlock forest. *Schwennesen 123, Schwennesen 124, Wiedemann 205-1, Peterson 205-2.*
+*Pinus ponderosa* Dougl.—Ponderosa pine. Planted on the main campus, but not observed in the field during this study. *Schwennesen (unnumbered).*
Pseudotsuga menziesii (Mirbel) Franco.—Douglas fir. Abundant. Locally dominant in Douglas-fir forest; scattered in Western red-cedar—western hemlock forest and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 206-2, Peterson 206-3, S. B. H. & R. S. 206-1, Schwennesen 125.*
Tsuga heterophylla (Raf.)Sarg.—Western hemlock. Common. Western red-cedar—western hemlock forest. *Lohmann 9.*

TAXACACEAE—Yew Family

Taxus brevifolia Nutt.—Pacific yew. Rare. Western red-cedar—western hemlock forest and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 169, Schwennesen 170, Wiedemann 207-1, Wiedemann 207-2*.

ANTHOPHYTA

Magnoliids

ARISTOLOCHIACEAE—Birthwort Family

Asarum caudatum Lindl.—Wild ginger. Rare. Western red-cedar—western hemlock forest. Not collected due to small population size.

Eudicots

ACERACEAE—Maple Family

Acer circinatum Pursh—Vine maple. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 1, Schwennesen 2.*
Acer macrophyllum Pursh—Big-leaf maple. Abundant. Red alder-bigleaf maple woodland and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 3.*

APIACEAE (formerly UMBELLIFERAE)—Carrot Family

**Daucus carota* L.—Queen Anne's lace. Common. Ruderal. Native to Europe. *Schwennesen 6, Schwennesen 7, Schwennesen 8.*

Oenanthe sarmentosa Presl.—American water-parsley. Locally abundant. Salmonberry – –skunk-cabbage riparian bogs. *Wiedemann 323-1.*

Osmorhiza chilensis H. & A.—Mountain sweet-cicely. Abundant. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and Douglas-fir forest. *Schwennesen 9, Wiedemann 420-2 (det. Brown).*

APOCYNACEAE—Dogbane Family

**Vinca major* L.—Periwinkle. Rare. Escaped ornamental established in a red alder—bigleaf maple woodland at edge of meadow. Native to Europe. *Lohmann 22.*

AQUIFOLIACEAE—Holly Family

**Ilex aquifolium* L.—English holly. Occasional. Douglas-fir forest and western red-cedar—western hemlock forest. Native to Europe. *Lohmann 24.*

ARALIACEAE—Ginseng Family

**Hedera helix* L.—English ivy. Locally abundant. Escaped ornamental heavily established in parts of Douglas-fir forest and western red-cedar—western hemlock forest. Native to Europe. *Lohmann 38.*

Oplopanax horridum (Smith) Miq.—Devil's club. Locally abundant. Salmonberry—skunk cabbage riparian bogs, especially in western red-cedar—western hemlock forest. *Lohmann 52.*

ASTERACEAE (formerly COMPOSITAE)—Aster Family

Adenocaulon bicolor Hook.—Pathfinder. Common. Douglas-fir forest and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennsen 192, Schwennesen 193, Wiedemann 45-1.*

Anaphalis margaritacea (L.) B. & H.—Pearly-everlasting. Edges of Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 46-1, Schwennesen 189, Schwennesen 190, Schwennesen 191.*

Aster chilensis Nees—Aster. Fields and ruderal. *Schwennesen 184, Schwennesen 185, Schwennesen 186.*

**Bellis perennis* L.—English daisy. Common. Ruderal. *Lohmann 6.*

Bidens frondosa L.—Leafy beggars-tick, sticktight. Ruderal. Not observed in the field during this study. *Schwennesen (un-numbered).*

**Chrysanthemum leucanthemum* L.—Oxeye daisy, moon daisy, marguerite. Occasional. Fields and ruderal. Native to Eurasia. *Schwennesen 181, Schwennesen 182, Schwennesen 183, Wiedemann 52-2.*

**Cirsium arvense* (L.) Scop. Var. *horridum* Wimm. & Grab.—Canadian thistle, creeping thistle. Occasional. Ruderal. Native to Eurasia. *S. B. H. & R. S. 47, Schwennesen 178, Schwennesen 179, Schwennesen 180.*

**Cirsium vulgare* (Savi) Tenore—Bull thistle, spear thistle, common thistle. Occasional.

Ruderal. Native to Eurasia. *Schwennesen 176, Schwennesen 177, Schwennesen (unnumbered), S. B. H. & R. S. 32.*

**Crepis iscose e* (L.) Wallr.—Smooth hawksbeard. Abundant. Ruderal. Native to Eurasia. *Schwennesen 175 (det. Campb.), Wiedemann (unnumbered), S. B. H. & R. S. 23, Wiedemann 56-2.*

**Crepis nicaeensis* Balb.—French hawksbeard. Ruderal. Not observred in the field during this study. Native to Europe. *Schwennesen 196.*

Grindelia integrifolia DC. var. *macrophylla* (Greene) Cronq.—Puget Sound gumweed. Rare. Lyngby's sedge—pickleweed salt marsh. *Wiedemann 411-1 (det. Gerrish).*

Hieracium albiflorum Hook.—White-flowered hawkweed. Sandy slopes at edges of western red-cedar—western hemlock forests. *Lohmann 35.*

**Hypochaeris radicata* L.—Hairy cat's-ear, false dandelion, gosmore. Abundant. Ruderal. Native to Europe. *Schwennesen 201 (det. Campbell), S. B. H. & R. S. 18, Wiedemann 61-2 (det. Gerrish).*

Jaumea carnosa (Less.) Gray.—Fleshy jaumea. Intertidal zone. Not observed in the field during this study. *Abair 63-1.*

**Lapsana communis* L.—Nipplewort. Occasional. Ruderal. Native to Eurasia. *Schwennesen 204, Schwennesen 205.*

**Leontodon nudicaulis* (L.) Merat ssp. *taraxacoides* (Vill.) Schinz & Thell.—Hairy hawkbit. Occasional. Ruderal. Native to Europe. *Wiedemann 417-1 (det. Gerrish), Schwennesen 206 (det. Campbell), Schwennesen (unnumbered, det. Campbell).*

Madia sativa Mol. var. *sativa*—Coast tarweed. Not observed in the field during this study. *Wiedemann 412-1.*

Matricaria matricarioides (Less.) Porter—Pineapple weed. Occasional. Ruderal. *Wiedemann 383-1.*

Petasites frigidus (L.) Fries var. *palmatus* (Ait.) Cronq.—Sweet coltsfoot. Occasional. Edges of Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 68-1.*

**Senecio jacobaea* L.—Tansy ragwort. Occasional. Ruderal. Native to Eurasia. *Schwennesen 208, Schwennesen 210, Wiedemann 74-1.*

**Senecio vulgaris* L.—Old-man-in-the-spring, old-man-in-the-woods, common groundsel. Occasional. Ruderal. Native to Eurasia. *Gerrish 452-1.*

Solidago iscose e L. var. *salebrosa* (Piper) Jones.—Canada goldenrod, meadow goldenrod. Abundant. Ruderal. *S. B. H. & R. S. 48, Schwennesen 211, Schwennesen 212, Wiedemann 414-4 (det. Gerrish).*

**Tanacetum vulgare* L.—Common tansy. Occasional. Ruderal. Native to Eurasia. *Rickert 8, Rickert 4.*

**Taraxacum officinale* Weber—Common dandelion. Abundant. Ruderal. Native to Eurasia. *Bowcutt 2286.*

BERBERIDACEAE—Barberry Family

Achlys triphylla (Smith.) DC.—Vanilla-leaf. Occasional. Moist areas in red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 6.*

Berberis aquifolium Pursh.—Shining Oregon-grape, tall Oregon-grape. Occasional. Douglas-fir forest and western red-cedar—western hemlock forest. *Schwennesen*

217.

Berberis nervosa Pursh.—Dull Oregon-grape, dwarf Oregon-grape. Abundant. Douglas-fir forest and western red-cedar—western hemlock forest. *Schwennesen 220, Schwennesen 221, Schwennesen 222, Wiedemann 8-2, Wiedemann 8-1.*

Vancouveria hexandra (Hook.) Morr. & Dec.—Inside-out flower. Occasional. Red alder––bigleaf maple forest. *Lohmann 21.*

BETULACEAE—Birch Family

Alnus rubra Bong.—Red alder. Common, locally dominant. Red alder—bigleaf maple woodland and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Soule 16, Wiedemann 10-1, Wiedemann 10-3, S. B. H. & R. S. 1.*

Corylus cornuta Marsh. var. *californica* (DC.)Sharp—Western hazelnut. Common. Open areas in red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *S. B. H. & R. S. 4, Wiedemann 12-1.*

BORAGINACEAE—Borage Family

**Anchusa cf. azurea* Mill.—Italian bugloss. Occasional. Ruderal. Native to Europe.*Lohmann 47.*

Myosotis arvensis(L.) Hill—Field forget-me-not, field scorpiongrass. Occasional Ruderal. Native to Europe. *Schwennesen 225, Schwennesen 226, Wiedemann 415-1 (det. Gerrish).*

**Myosotis discolor* Pers.—Yellow and blue forget-me-not. Occasional. Ruderal. Native to Europe. *Wiedemann 416-1 (det. Gerrish).*

Myosotis laxa Lehm.—Small-flowered forget-me-not. Occasional. Wet fields. *Schwennesen 224 (det. Campbell), Schwennesen 227, Wiedemann 19-1.*

**Symphytum officinale* L.—Common comfrey. Occasional. Escaped from cultivation at edges of bigleaf maple forest. Native to Europe.

BRASSICACEAE (formerly CRUCIFERAE)—Mustard Family

**Barbarea vulgaris* R. Br.—Yellow rocket. Occasional. Ruderal Native to Europe. *Schwennesen (unnumbered).*

**Capsella bursa-pastoris* L.—Shepherd's-purse. Abundant. Ruderal. Native to Europe. *Wiedemann 91-1, Gerrish 91-2.*

Cardamine angulata Hook.—Angled bittercress. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 92-3.*

Cardamine flexuosa With.—Bittercress. Occasional. Ruderal. *Gerrish 95-2 (det. Zika), Peterson 95-1 (det. Zika).*

Cardamine oligosperma var. *oligosperma* Nutt.—Little western bittercress. Common. Ruderal. *Wiedemann 94-1, Schwennesen 231.*

**Hesperis matronalis* L.—Damask violet, dame's violet, sweet rocket. Occasional. Forest-edges and roadsides. Native to Europe. *Schwennesen (unnumbered, two specimens).*

**Sisymbrium officinale* (L.) Scop.—Hedge mustard. Occasional. Ruderal. Native to Europe. *Schwennesen 233, Schwennesen (unnumbered).*

**Teesdalia nudicaulis* (L.) R. Br.—Shepherd's cress. Common. Ruderal. Native to

Europe. *Wiedemann 100-2 (det. Gerrish), Gerrish 100-3.*

CAPRIFOLIACEAE—Honeysuckle Family

Linnaea borealis L. var. *longifolia* Torr.—Twinflower. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and Douglas-fir forest. *Schwennesen 35, Lohmann 50.*

Lonicera ciliosa (Pursh) DC.—Northwest honeysuckle, trumpet honeysuckle, orange honeysuckle. Common. Edges of all forest types. *Schwennesen 36, Wiedemann 24-2 (det. Schwennesen).*

**Lonicera etrusca* Santi—Estruscan honeysuckle. Locally abundant. Established at edge of red alder—bigleaf maple woodland. Native to the Mediterranean. *Lohmann 44.*

Lonicera hispidula (Lindl.) Dougl.—California honeysuckle, hairy honeysuckle, pink honeysuckle. Occasional. Edges of all forest types. *Schwennesen 38 (det. Campbell), Schwennesen (unnumbered, det. Campbell).*

Lonicera involucrata (Rich.) Banks var. *involucrata*.—Black twinberry. Occasional. Willow—hardhack riparian scrub and edges of all forest types. *Wiedemann & Gerrish (unnumbered), Neill 4670, Smith (unnumbered).*

Sambucus racemosa L. var. *arborescens* (T. & G.) Gray.—Red elderberry. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and Douglas-fir forest. *Wiedemann 27-2, Wiedemann 27-2.*

Symphoricarpos albus (L.) Blake.—Common snowberry. Occasional. Douglas-fir forest and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Lohmann 34.*

CARYOPHYLLACEAE—Pink Family

**Cerastium viscosum* L.—Sticky chickweed. Occasional. Ruderal. Native to Europe. *Schwennesen 44, Wiedemann 413-1 (det. Gerrish).*

**Lychnis alba* Mill.—Evening campion. Not observed in the field during this study. Native to Europe. *Wiedemann 31-1.*

Spergularia canadensis (Pers.) G. Don.—Canadian sandspurry. Occasional. Gravelly and sandy beach. *Schwennesen 47, Schwennesen (unnumbered).*

**Stellaria media* (L.) Cyrill.—Chickweed. Occasional. Red alder—bigleaf maple forest and ruderal. Native to Europe. *Neill 4652, Wiedemann 34-1, Wiedemann 32-2.*

CHENOPODIACEAE—Goosefoot Family

Salicornia virginica L.—Pickleweed, woody glasswort. Locally abundant. Lyngby's sedge—pickleweed salt marsh. *Wiedemann 41-1.*

CORNACEAE—Dogwood Family

Cornus nuttallii Aud.—Western dogwood. Rare. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 85-2, Soule 13.*

ERICACEAE—Heath Family

Arbutus mensiezii Pursh.—Madrone. Occasional. Edges of Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and western red-cedar—western hemlock forest, especially near beach. *Wiedemann 106-2.*

Chimaphila umbellata (L.) Bart. var. *occidentalis* (Rydb.) Blake—Prince's-pine. Rare. Douglas-fir forest. Not observed in the field during this study. *Wiedemann 110-2.*

Gaultheria shallon Pursh—Salal. Abundant. Dominant in Douglas-fir forest, common in other forest types. *Schwennesen 238, Schwennesen 238, Schwennesen (unnumbered), S. B. H. & R. S. 8, Peterson 112-3, Wiedemann 112-2, Soule 4, Lohmann 51.*

Monotropa uniflora L.—Indian pipe. Rare. Western red-cedar—western hemlock forest. Not observed in the field during this study. *Wiedemann 116-1.*

Vaccinium ovatum Pursh.—Evergreen huckleberry. Common. Douglas-fir forest and Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 244, Schwennesen 245, Schwennesen 246, Schwennesen (unnumbered).*

Vaccinium parvifolium Smith.—Red huckleberry. Common. Red alder—bigleaf maple woodland and all forest types. *Schwennesen (unnumbered), S. B. H. & R. S. 7.*

FABACEAE (formerly LEGUMINOSAE)—Pea Family

**Cytisus scoparius* (L.) Link.—Locally abundant. Willow—hardhack riparian scrub and ruderal. Native to Europe. *Schwennesen 247, Schwennesen 249, Peterson 148-2, Wiedemann 148-3.*

Lathyrus polyphyllus Nutt.—Leafy peavine. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest *Wiedemann 418-1 (det. Gerrish).*

**Lotus corniculatus* L.—Birdsfoot-trefoil. Occasional. Fields. Native to Europe. *Schwennesen 253, Schwennesen 254.*

Lotus crassifolius(Benth.) Greene var. *subglaber* (Ottley) Hitchc.—Big deervetch. Occasional. Ruderal. *Wiedemann 152-2, Wiedemann (unnumbered), Schwennesen 255, Lohmann 20.*

Lotus micranthus Benth.—Small-flowered deervetch. Occasional. Fields and ruderal. *Wiedemann 154-2 (det. Gerrish).*

*Lupinus polyphyllus*Lindl. var. *pallidipes* (Heller) Smith.—Many-leaved lupine. Occasional. Ruderal. *Schwennesen 257 (det. Campbell), Schwennesen 258 (det. Campbell).*

**Robinia pseudo-acacia* L.—Black or yellow locust, false acacia. Naturalized garden remnant. Beach at edge of western red-cedar—western hemlock forest. Native to eastern North America. *Lohmann 33.*

Trifolium dubium Sibth.—Least hop-clover. Abundant. Fields and ruderal. *Wiedemann 157-3, Schwennesen 261.*

**Trifolium pratense* L.—Red clover. Abundant. Fields and ruderal. Native to Europe. *S. B. H. & R. S. 30.*

**Trifolium repens* L.—White clover, Dutch clover. Abundant. Fields and ruderal. Native to Europe. *Schwennesen 269, Schwennesen 269, S. B. H. & R. S. 29.*

**Vicia hirsuta* (L.) S. F. Gray—Tiny vetch. Occasional. Ruderal. Native to Europe. *Wiedemann 166-1.*

**Vicia sativa* L. var. *angustifolia* (L.) Wahlb.—Common vetch. Common. Ruderal. Native to Europe. *Wiedemann 167-1.*

FUMARIACEAE—Fumitory Family

Dicentra formosa (Andr.) Walp.—Pacific bleedingheart. Common. Red alder—bigleaf maple woodland, Red alder—bigleaf maple—Douglas-fir—western red-cedar forest, and ruderal. *Wiedemann 122-2, Smith (unnumbered).*

GENTIANACEAE—Gentian Family

**Centaurium umbellatum* Gilib.—European centaury, common centaury. Occasional. Roadsides, waste areas. Native to Europe. *Schwennesen 70, Schwennesen 71, Wiedemann 123-2, S. B. H. & R. S. 22.*

GERANIACEAE—Geranium Family

**Erodium cicutarium* (L.) L'Her.—Crane's-bill. Occasional. Ruderal. *Schwennesen (unnumbered).*

**Geranium robertianum* L.—Herb Robert. Occasional in red alder—bigleaf maple woodland, locally abundant in ruderal areas. Native to Europe. *Lohmann 13.*

GROSSULARIACEAE—Currant Family

Ribes bracteosum Dougl.—Stink currant. Locally abundant. Salmonberry—skunk-cabbage riparian bogs, especially in red alder—bigleaf maple—Douglas-fir—western red-cedar forests. *Lohmann 40.*

Ribes sanguineum Pursh—Redflowering currant, red currant, blood currant. Occasional. Edges of red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Schwennesen 73, Smith (unnumbered), Peterson 127-2.*

HIPPOCASTANACEAE—Horse-chestnut family

*+*Aesculus hippocastanum* L.—Horse chestnut. Single individual growing at the edge of a red alder—bigleaf maple woodland. *Lohmann 45.*

HYDROPHYLLACEAE—Waterleaf Family

Hydrophyllum tenuipes Heller—Pacific waterleaf, slender-stemmed waterleaf. Abundant. Red alder—bigleaf maple woodland and red alder—bigleaf maple—Douglas-fir––western red-cedar forest. *Schwennesen 74, Schwennesen 75, Wallding 87, Wiedemann 130-1, Wiedemann 130-2.*

Nemophila parviflora var. *parviflora* Dougl.—Small-flowered nemophila. Common. Red alder—bigleaf maple woodland. *Schwennesen 77, Lohmann 14.*

Nemophila pedunculata Dougl.—Meadow nemophila. Occasional. Fields. *Gerrish 131-3, Wiedemann 131-1 (det. Gerrish), Wiedemann 131-2 (det. Gerrish).*

HYPERICACEAE—St. John's-wort Family

Hypericum anagalloides C. &. S. Bog St. John's-wort. Rare. Wet meadow. Not observed in the field during this study. *Schwennesen 78, Schwennesen 79, Schwennesen 80.*

**Hypericum perforatum* L.—Common St. John's-wort. Occasional. Ruderal. Native to Europe. *Schwennesen 81, Schwennesen 82, Schwennesen 84, Lohmann 43.*

LAMIACEAE (formerly LABIATAE)—Mint Family

**Glecoma hedeacea* L.—Ground ivy. Occasional. Ruderal. Native to Eurasia. *Wiedemann 139-1.*

Mentha arvensis L. var. *glabrata* (Benth.) Fern.—Field mint. Occasional. Ruderal. *Schwennesen 92, Schwennesen 93, Schwennesen 94, Wiedemann (unnumbered), Gerrish 429-1.*

**Origanum vulgare* L. Oregano.Rare. Ruderal. Not observed in the field as part of this study. Native to Eurasia. *Rickert 2, Rickert 3.*

Prunella vulgaris L.—Self-heal. Abundant. Ruderal. *Schwennesen 96, Schwennesen 97, S. B. H. & R. S. 20, Wiedemann 141-2.*

Stachys cooleyae Heller—Cooley's hedge-nettle. Occasional. Ruderal. *Schwennesen 98, Schwennesen 99, Schwennesen (unnumbered).*

ONAGRACEAE—Willow-herb Family

Circaea alpina L.—Enchanter's nightshade. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and red alder—bigleaf maple woodland. *Schwennesen 111, Lohmann 41.*

Epilobium angustifolium L.—Fireweed. Occasional. Ruderal. *Schwennesen (unnumbered, two specimens), S. B. H. & R. S. 19.*

Epilobium watsonii Barbey—Watson's willow-herb. Occasional. Ruderal. *Gerrish 199-1 (det. Smith), Wiedemann 199-2 (det. Smith), Wiedemann 199-3 (det. Smith), Schwennesen 112, Schwennesen 113, Schwennesen 114.*

**Oenothera* × *erythrosepala* Borb.—Red-sepaled evening-primrose. Rare. Ruderal. Escaped garden hybrid. Not observed in the field during this study. *Burg (unnumbered).*

OXALIDACEAE—Oxalis Family

Oxalis oregana Nutt.—Oregon wood-sorrel. Rare. Established (probably planted) near Organic Farm. *Lohmann 48.*

PLANTAGINACEAE—Plantain Family

**Plantago lanceolata* L.—English plantain. Common. Fields and ruderal. Native to Europe. *S. B. H. & R. S. 35, S. B. H. & R. S. 56 (det. Smith).*

**Plantago major* L.—Common plantain, nippleseed plantain. Common. Fields and ruderal. Native to Europe. *Schwennesen (unnumbered).*

Plantago maritima L.—Seaside plantain. Occasional. Lyngby's sedge—pickleweed salt marsh and along beach. *Schwennesen 130 (det. Campbell), Schwennesen 131 (det. Campbell), Schwennesen (unnumbered), Wiedemann 210-2 (det. Gerrish).*

POLYGONACEAE—Buckwheat Family

Polygonum fowleri Robins.—Fowler's knotweed. Rare. Sandy or gravelly beach. Not observed in the field during this study. *Schwennesen 138, Schwennesen (unnumbered).*

Polygonum persicaria L.—Lady's thumb, heartweed. Occasional. Ruderal. *Schwennesen 140 (det. Campbell), Schwennesen 141, Schwennesen 142, S. B. H. & R. S. 408-1*

(det. Gerrish).
**Rumex acetosella* L.—Sheep sorrel, sour dock. Abundant. Fields and ruderal; prefers acidic soil. Native to Europe. *Schwennesen 143, Schwennesen 144, Schwennesen 145, Wiedemann 228-1, S. B. H. & R. S. 34.*
**Rumex crispus* L.—Curly dock. Common. Ruderal. Native to Europe. *Lohmann 31.*
Rumex obtusifolius L.—Bitterdock, butterdock, broad-leaved dock. Common. Ruderal. *S. B. H. & R. S. 33, Schwennesen 147, Schwennesen 148, Schwennesen 149.*

PORTULACACEAE—Purslane Family

Montia sibirica (L.) Howell—Siberian miner's-lettuce, candyflower. Abundant. Red alder—bigleaf maple woodland, all forest types, and ruderal. *Smith (unnumbered), Schwennesen 150, Neill 4654, Wiedemann 238-1, Peterson 237-1.*

PRIMULACEAE—Primrose Family

Glaux maritima L.—Saltwort, sea-milkwort. Rare. Beach. Not observed in the field during this study. *Wiedemann 242-1.*
Trientalis latifolia Hook.—Western starflower, broadleaved starflower. Common. Douglas-fir forest and western red-cedar—western hemlock forest. *Schwennesen (unnumbered), Wiedemann 243-1, Wiedemann 243-2,*

RANUNCULACEAE—Buttercup Family

Actaea rubra (Ait.) Willd.—Baneberry. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Neill 4676.*
Ranunculus occidentalis Nutt.—Western buttercup. Rare. Not observed in the field during this study. *Peterson 253-1.*
**Ranunculus repens* L.—Creeping buttercup. Abundant. Red alder—bigleaf maple woodland, fields and ruderal. Native to Europe. *Schwennesen 275.*
Ranunculus uncinatus D. Don var. *parviflorus* (Torr.) Benson—Little buttercup. Occasional. Red alder—bigleaf maple woodland. *Schwennesen (unnumbered), Wiedemann 409-1 (det. Gerrish).*
Ranunculus uncinatus D. Don var. *uncinatus*—Little buttercup. Occasional. Red alder—western red-cedar woodland. *Neill 4677.*

RHAMNACEAE—Buckthorn Family

Rhamnus purshiana DC.—Cascara. Occasional. All forest types. *Lohmann 8.*

ROSACEAE—Rose Family

Amelanchier alnifolia Nutt. var. *semiintegrifolia* (Hook.) Hitch.—Saskatoon, serviceberry, shadbush. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 259-1.*
Geum macrophyllum Willd. var. *macrophyllum*—Largeleaved avens. Locally abundant. Red alder—bigleaf maple woodland and ruderal. *Wiedemann 262-1, Lohmann 42.*
Holodiscus discolor (Pursh) Maxim.—Creambush ocean-spray. Common. Red alder—bigleaf maple woodland, red alder—bigleaf maple—Douglas-fir—western red-cedar forest, and Douglas-fir forest. *Wiedemann 264-1.*

Oemleria cerasiformis (H. & A.) Landon—Osoberry. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and red alder—bigleaf maple woodland. *Wiedemann 266-2, Wiedemann 266-3, Peterson 266-4.* N.B.: All specimens are labeled "*Osmaronia cerasiformis* (T. & G.) Greene."

Prunus emarginata (Dougl.) Walp.—bittercherry. Occasional. Edges of red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *S. B. H. & R. S. 10, Wiedemann 269-2 (det. Gerrish), Wiedemann 269-1, Schwennesen 287.*

Prunus virginiana L. var. *demissa* (Nutt.) Torr.—Common chokecherry. Not observed in the field during this study. *Holder 395-1.*

Pyrus fusca Raf.—Western crabapple. A few individuals on beach at edge of red alder—bigleaf maple—western red-cedar—Douglas-fir forest. *Lohmann 36.*

Rosa gymnocarpa Nutt.—Baldhip rose, little wild rose. Occasional. All forest types. *Schwennesen (unnumbered).*

Rosa pisocarpa Gray—Peafruit rose. Rare. Beach at edge of western redcedar—western hemlock forest. *Lohmann 27.*

**Rubus discolor* Weihe & Nees—Himalayan blackberry. Occasional. Ruderal. Native to Eurasia. *Lohmann 32, Lohmann 46.*

**Rubus laciniatus* Willd.—Evergreen blackberry. Rare. Ruderal. Native to Europe. *Schwennesen 289, Schwennesen (unnumbered), S. B. H. & R. S. 11.*

Rubus parviflorus Nutt.—Thimbleberry. Common. Red alder—bigleaf maple woodland, red alder—bigleaf maple—Douglas-fir—western red-cedar forest, salmonberry—skunk-cabbage riparian bogs, willow—hardhack riparian scrub. *Schwennesen 290, Schwennesen 291, Schwennesen (unnumbered), Wiedemann 275-2.*

Rubus spectabilis Pursh—Salmonberry. Common, locally dominant. Red alder—bigleaf maple woodland, red alder—bigleaf maple—Douglas-fir—western red-cedar forest, salmonberry—skunk-cabbage riparian bogs. *Smith (unnumbered), Schwennesen 292.*

Rubus ursinus Cham. & Schlecht.—Pacific blackberry. Abundant. Nearly ubiquitous in red alder—bigleaf maple woodland, all forest types, and many ruderal areas. *S. B. H. & R. S. 12, Schwennesen 293, Schwennesen 294, Peterson 277-3, Wiedemann 277-1.*

Spiraea douglasii Hook., var. *menziesii* (Hook.) Presl—Western spiraea, hardhack. Common. Willow—hardhack riparian scrub. *Schwennesen 297, Schwennesen 298, S. B. H. & R. S. 5, Wiedemann 282-2 (det. Gerrish).*

RUBIACEAE—Madder Family

Galium trifidum L.—Small bedstraw. Common. Ruderal. *Schwennesen 301, Schwennesen 302 (det. Campbell), Schwennesen 303.*

Galium triflorum Michx.—Sweetscented bedstraw. Occasional. Ruderal. *Schwennesen 304, Schwennesen 305.*

RUTACEAE—Rue Family

**Skimmia japonica* Thunb.—Skimmia. Rare. Garden ornamental planted and apparently naturalizing along a paved walkway in Douglas-fir forest at the edge of campus. Native to Asia. *Lohmann 37.*

SALICACEAE—Willow Family

+*Populus alba* L.—Silver poplar. Rare. Edges of red alder—bigleaf maple woodland. Native to Eurasia. No evidence of naturalization. *Holder 384-1.*

Populus trichocarpa T. & G.—Black cottonwood. Occasional. Edges of red alder—bigleaf maple—western red-cedar—Douglas fir forest. *Lohmann 28.*

Salix hookeriana Barratt—Hooker's willow. Occasional. Willow—hardhack riparian scrub. *Wiedemann* (unnumbered).

Salix lasiandra Benth.—Pacific willow. Occasional. Willow—hardhack riparian scrub and edges of red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Neill 4668, Neill 4671.*

Salix scouleriana Barratt.—Scouler willow. Occasional. Willow—hardhack riparian scrub. *Neill 4667.*

Salix sitchensis Sanson—Sitka willow. Occasional. Willow—hardhack riparian scrub. *Neill 4658.*

SAXIFRAGACEAE—Saxifrage Family

Chrysoplenium glechomaefolium Nutt.—Western golden-carpet. Rare. Salmonberry—skunk cabbage riparian bogs. Not observed in the field during this study. *Smith* (unnumbered).

Tellima grandiflora (Pursh) Dougl.—Fragrant fringecup. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 301-2 (det. Brown).*

Tolmeia menziesii (Pursh) T. & G.—Youth-on-age, pig-a-back plant. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and ruderal. *Wiedemann 304-2 (det. Brown), Wiedemann 304-3 (det. Brown), Schwennesen 153.*

Tiarella trifoliata L. var. *trifoliata*—Trefoil foamflower. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest and salmonberry—skunk-cabbage riparian bogs. *Lohmann 19.*

SCROPHULARIACEAE—Figwort Family

Digitalis purpurea L.—Foxglove. Locally abundant. Ruderal. Native to Eurasia. *Wiedemann 310-1, Wiedemann 310-2, Schwennesen 155.*

Mimulus guttatus DC. var. *guttatus*—Yellow monkeyflower. Occasional. Ruderal. *Schwennesen 157, Schwennesen 158.*

**Parentucellia iscose* (L.) Car.—Yellow parentucellia. Locally abundant. Fields and ruderal. Native to Mediterranean. *Schwennesen 159, Schwennesen 160, Schwennesen 161, Wiedemann 361-3, Wiedemann 361-4.*

Synthyris reniformis (Dougl.) Benth.—Spring queen, snow-queen, round-leaved synthyris. Western red-cedar—western hemlock forest. Not observed in the field during this study. *Wiedemann 314-2 (det. Gerrish), Peterson 314-3.*

Veronica scutellata L.—Marsh speedwell. Wet meadow. Not observed in the field during this study. *Schwennesen 165.*

**Veronica serpyllifolia* L. var. *serpyllifolia.* Common. Ruderal. Native to Europe. *Wiedemann 410-1 (det. Gerrish), Wiedemann 410-2 (det. Gerrish).*

URTICACEAE—Nettle Family

Urtica dioica L. var. *lyallii* (Wats.) Hitchc.—Stinging nettle. Locally abundant. Moist ditches and edges of red alder—bigleaf maple woodland. *Lohmann 29.*

VIOLACEAE—Violet Family

Viola glabella Nutt.—Stream violet. Occasional. Red alder—bigleaf maple woodland and red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Lohmann 39.*

Viola sempervirens Greene—Evergreen violet. Occasional. All forest types. *Wiedemann 400-1, Smith (unnumbered).*

Monocotyledoneae

ARACEAE—Arum Family

Lysichitum americanum Hultén & St. John—Skunk cabbage. Locally abundant. Salmonberry—skunk-cabbage riparian bogs. *Wiedemann 3.*

CYPERACEAE—Sedge Family

Carex amplifolia Boott.—Big-leaf sedge, ample-leafed sedge. Locally abundant. Salmonberry—skunk-cabbage riparian bogs. *Wozniak 9.*

Carex cf. *deweyana* Schw.—Dewey's sedge. Occasional. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Lohmann 16.*

Carex lyngbyei Hornem var. *robusta* (Bailey) Cronq.—Lyngby's sedge. Locally dominant. Salt marsh. *Lohmann 25.*

Carex cf. *obnupta* Bailey—Slough sedge. Ruderal. *Schwennesen 63.*

JUNCACEAE—Rush Family

Juncus effusus L. ssp. *pacificus* (Fernald &Wigand) Lint.—Soft rush, common rush. Common. Ruderal. *Schwennesen 85 (det. Zika).*

Juncus tenuis Willd.—Slender rush. Ruderal. Not observed in the field during this study. *Schwennesen 91 (det. Zika).*

Juncus ensifolius Wikst. Dagger-leaf rush. Not observed in the field during this study. Wet meadow. *Schwennesen 87.*

Luzula campestris (L.) DC.—Field woodrush. Occasional. Sandy cliffs near beach, red alder—bigleaf maple—Douglas-fir—western red-cedar forest, and ruderal. *Lohmann 10, Lohmann 49.*

JUNCAGINACEAE—Arrowgrass Family

Triglochin maritimum L.—Maritime arrowgrass. Locally abundant. Salt marsh. *Lohmann 26.*

LILIACEAE—Lily Family

Disporum hookeri (Torr.) Nicholson var. *oreganum* (Wats.) Jones—Hooker fairy-bell. Rare. Western red-cedar—western hemlock forest. *Lohmann 17.*

Lilium columbianum Hanson—Tiger lily. Rare. Western red-cedar—western hemlock forest. Not observed in the field during this study. *Wiedemann 177-1, Wiedemann 177-2.*

Maianthemum dilatatum (Wood) Nels. & Macbr.—Beadruby, deerberry, may-lily, false lily-of-the-valley. Common. Moist areas in all forest types. *Schwennesen 102.*

Smilacina racemosa (L.) Desf.—False Solomon's seal, false spikenard, western Solomon-plume. Common. Red alder—bigleaf maple—Douglas-fir—western red-cedar forest. *Wiedemann 180-1, Schwennesen 104, Schwennesen 105, Neill 4678.*

Smilacina stellata (L.) Desf—Starry Solomon-plume. Occasional. Salmonberry—skunk-cabbage riparian bogs and western red-cedar—western hemlock forest. *Lohmann 18.*

Streptopus amplexifolius (L.) DC. var. *americanus* Schult.—Clasping-leaved twisted-stalk. Occasional. Salmonberry—skunk-cabbage riparian bogs. *Lohmann 11, Lohmann 12.*

Trillium ovatum Pursh—Wake-robin. Occasional. Douglas-fir forest and western red-cedar—western hemlock forest. *Peterson 184-3, Wiedemann 184-2, Lohmann 2.*

ORCHIDACEAE—Orchid Family

Calypso bulbosa (L.) Oakes.—Fairy-slipper, Venus-slipper. Rare. Western red-cedar—western hemlock forest. Not collected due to small population size.

Corallorhiza maculata Raf.—Spotted coralroot. Occasional. Douglas-fir forest. *Lohmann 7.*

Goodyera oblongifolia Raf.—Western rattlesnake plantain. Occasional. Douglas-fir forest. Not observed in the field during this study. *Schwennesen 118, Schwennesen 119, Wiedemann 201-1, Brockway & Williams 201-2.*

Spiranthes romanzoffiana Cham. Ladies-tresses. Rare. Wet meadow, moist roadsides. Not observed in the field during this study. *Schwennesen 120, Schwennesen 121, S. B. H. &. R. S. 16, Gerrish 202-2.*

POACEAE—Grass Family

**Aira caryophyllea* L.—Silver hairgrass. Common. Non-native perennial grasslands. Native to Europe. *S.B.H. and R. S. 44.*

**Aira praecox* L.—Early hairgrass, little hairgrass. Rare. Non-native perennial grasslands. Native to Europe. *S.B.H. and R.S. 40 (det. Smith).*

**Anthoxanthum odoratum* L.—Sweet vernalgrass. Common, locally dominant. Non-native perennial grasslands and ruderal. Native to Europe. *Lohmann 15.*

**Dactylis glomerata* L. Orchard-grass, cock's-foot grass. Abundant. Non-native perennial grasslands and ruderal. Native to Eurasia. *Wozniak 1.*

Festuca cf. *ovina* L., var. *rydbergbii* St.-Yves—Sheep fescue. Occasional. Non-native perennial grasslands. *Wozniak 11.*

Festuca cf. *subuliflora* Scribn.—Coast Range fescue, crinkle awn fescue. Common. Non-native perennial grasslands. *Wozniak 15.*

Glyceria borealis (Nash) Batch.—Northern mannagrass. Rare. Around Seminar II Building. *Wozniak 10.*

**Holcus lanatus* L.—Common velvetgrass. Common, locally dominant. Non-native

Holcus mollis L.—Creeping softgrass, creeping velvetgrass. Occasional. Meadow near longhouse. Native to Europe. *Wozniak 8.*

Lolium multiflorum Lam.—Italian ryegrass, Australian ryegrass. Common. Non-native perennial grasslands. Native to Europe. *Wozniak 5.*

K

STUDENT NAMING REPORT
(2007)

This report was provided by Evergreen students Sara Apler and Nathaniel Ashlock in the Community Design, Community Action program (spring quarter 2007). It provides recommendations for the process of naming within the college Reserves.

Sara Apler and Nathaniel Ashlock
Community Design, Community Action
Rob Knapp and Helena Myer-Knapp
June 10, 2007

THE NAMER'S MANIFESTO

We propose to generate names for the Evergreen State College forest reserves in order to protect the reserves from careless development; to provide the land with a spirit and identity that reflect the Evergreen community; to promote education and awareness of Evergreen's natural and cultural histories; and to promote education and awareness of Evergreen's natural resources.

In order to achieve these goals we propose a system of naming that will emphasize Evergreen's leadership in sustainability and its strong history as decentralized democratic community. (However, we are aware of Evergreen's recent centralization of decision making processes.)

What the Naming Process Covers:
Every identifiable forest, grove, meadow, wetland, and beach outside of the Core campus will be eligible to be named. Please see map of the reserves for details.

Qualified Names:

1) Names must be historically significant to the college or the land.

2) Names must be regionally significant (Western Washington should be the first consideration followed by the entire state).

3) For any name proposed to honor a person, the person must have been dead for at least five years.

The Initiative Process:

1) Any student, faculty, or staff can propose a name.

2) In order to get a name on the ballot one needs to acquire:

7% of students at Olympia Campus
7% of faculty at Olympia campus
7% of staff at Olympia campus

3) If there is the demand, elections will be held every quarter. Full signatures must be acquired one quarter ahead of the next elections (For a vote at the end of Spring Quarter all signatures must be turned in by the end of Winter Quarter.)

4) All students, faculty, and staff at Olympia campus are eligible to vote on name suggestions.

5) Once approved through a vote, a Geoduck Student Union representative will present the selection as a recommendation to the Board of Trustees. This allows the Board of Trustees to maintain their authority to name all spaces on campus.

Timetable:
There is no timetable for naming the natural spaces in the reserves. The names change as the

community finds the motivation to name them.

Further Recommendations:

1) We recommend that a poll be held on gateway to create a unifying theme for all names.

2) We recommend that after the Board of Trustees approves a name that an official naming ceremony be held.

3) We recommend that ultimately, the authority to name the reserves be delegated to the Geoduck Student Union by the Board of Trustees.

4) We recommend that the Board of Trustees consider a process for naming buildings and spaces in the Core campus that is both democratic and able to generate funds for donors.

L

BUILDING INVENTORY
(February, 2007)

Table provided by Ray Ruiz, Facilities Supervisor, Residential and Dining Services, showing square footages for buildings on campus.

BUILDING SQUARE FOOTAGE LIST
BY BUILDING

NO. - BUILDING	GROSS	CONST YF	CONST TYPE	CUPANCY T		Occupancy Addres	Tax Parcel No.	Zoning	UBC
001 - Library	346,969	1971	I - FR & II-FR	A-2.1 & B-2	2737	McCann Plaza NW	12806410000		
002 - Lecture Halls	23,639	1971	I - FR	A-2.1	2725	McCann Plaza NW			
003 - CRC	115,679	1972	I - FR	A-2.1	2745	McCann Plaza NW			
004 - Lab I	85,269	1972	I - FR	B	2713	McCann Plaza NW			
005 - CUP	24,913	1971	I - FR	H-7	2836	Fireweed Dr. NW			
006 - Shops	12,701	1971	V - B	S-3 & H-4	3540	Driftwood Rd. NW			
007 - Garage	2,709	1971	V - N	H-4	3538	Driftwood Rd. NW			
008 - Water Pump Station	1,881	1970	IV - N		2648	Overhulse Rd. NW			
009 - Covered Rec. Pavillion	18,559	1973	V - N	A-3	4201	Driftwood Rd. NW			
010 - Presidents Residence	5,559	0	V - N		4202	Leavelle St. NW			
011 - Seminar	44,909	1974	I - FR	A-2.1 & B-2	2731	McCann Plaza NW			
012 - Lab II	88,176	1975	I - FR	B	2721	McCann Plaza NW			
013 - Combustable Storage	508	1974	V - N	H-2 / H-7	3506	Driftwood Rd. NW			
014 - Comm Lab	121,513	1977	I - FR - Sprinkled & II-FR	A-1 & A-2.1 & B	2749	McCann Plaza NW			
015 - Lab Annex	27,377	1973	I - FR - Sprinkled	B-2 & H-2	2709	McCann Plaza NW			
016 - Utility Tunnels	40,137	2004	I - FR			Not occupied			
018 - Seminar II	198,775	2,003	II - FR	B & A-3	2751	McCann Plaza NW		RR 1/5	1997
101 - CAB	112,238	1972	I - FR	A-2.1 & B-2	2741	McCann Plaza NW			
102 - Dorm "A"	47,510	1971	V-N & Sprinkled	R-1	4315	Indian Pipe Lp NW			
103 - Dorm "B"	20,332	1971	V-N	R-1	4319	Indian Pipe Lp NW			
104 - Dorm "C"	20,332	1971	V-N	R-1	4323	Indian Pipe Lp NW			
105 - Dorm "D"	20,332	1971	V-N & Sprinkled	R-1	4327	Indian Pipe Lp NW			
106 - Residence Apartment "E"	8,305	1987	V - N		4201	Indian Pipe Lp NW			
107 - Residence Apartment "F"	9,803	1987	V - N		4203	Indian Pipe Lp NW			
108 - Residence Apartment "G"	8,305	1987	V - N		4205	Indian Pipe Lp NW			
109 - Residence Apartment "H"	9,803	1987	V - N		4207	Indian Pipe Lp NW			
110 - Residence Apartment "I"	7,969	1987	V - N		4231	Indian Pipe Lp NW			
111 - Residence Apartment "J"	8,305	1987	V - N		4229	Indian Pipe Lp NW			
112 - Residence Apartment "K"	8,305	1987	V - N		4227	Indian Pipe Lp NW			
113 - Residence Community Center	7,218	1987	V - N	R-1 & A3	4225	Driftwood Rd. NW			
114 - Residence Apartment "N"	8,617	1989	V - N		4223	Indian Pipe Lp NW			
115 - Residence Apartment "P"	8,617	1989	V - N		4221	Indian Pipe Lp NW			
116 - Residence Apartment "Q"	8,617	1989	V - N		4219	Indian Pipe Lp NW			
117 - Residence Apartment "R"	10,682	1989	V - N		4217	Indian Pipe Lp NW			
118 - Residence Apartment "S"	8,617	1989	V - N		4215	Indian Pipe Lp NW			
119 - Residence Apartment "T"	8,617	1989	V - N		4211	Indian Pipe Lp NW			
120 - Residence Apartment "U"	8,617	1989	V - N		4209	Indian Pipe Lp NW			
201 - Child Care Center	6,477	1969	V - N	E-3	2824	Fireweed Dr. NW			
204 - Geoduck House	3,785	1971	V - N		4346	Sunset Beach Dr. NW			
205 - Pottery Shop (Driftwood House)	1,390	1971	V-1H	C-3	4900	Driftwood Dr. NW - 9			
206 - Organic Farm House	3,479	1972	V - N	R-1	2712	Lewis Rd. NW #A			
210 - Well House	59	1969	V - N			Not occupied			
213 - Grounds Office	216	1975	V - N	B	3544	Driftwood Rd. NW			
214 - Pottery Shop Annex (Leasure Ed)	811	1972	V - N	C-3		Not occupied			
215 - Grounds Equipment & Vehicle Storage	2,700	1975	V - N	S-1	3528	Driftwood Rd. NW			
216 - Grounds Supply Storage	4,800	1969	V - N	S-1	3528	Driftwood Rd. NW			
218 - Parking Booth	48	1990	V - N	B-2	2701	McCann Plaza NW			
219 - Organic Farm Operations	864	1990	V - N	B-2	2712	Lewis Rd. NW #B			
220 - Organic Farm Storage	432	0	V - N	S-1	2712	Lewis Rd. NW #C			
221 - Longhouse	12,177	1995	Type III - 1hr & V - Heavy Timber		2800	Dogtooth Lane NW #			
222 - Shops Storage	1,152	0	V - N	S-1	3534	Driftwood Rd. NW			
223 - Kiefer residence									
224 - Emergency Preparedness Storage	1,580	1996	V - N		2818	Fireweed Dr. NW			
301 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
302 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
303 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
304 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
305 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
306 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
307 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
308 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
309 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
310 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
311 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
312 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
313 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
314 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
315 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
316 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			
317 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW			

315 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW	
316 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW	
317 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW	
318 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW	
319 - MOD Housing	1,584	1971	V - N		3040	Wild Current Loop NW	
320 - MOD Housing Laundry	527	1971	V - N		3040	Wild Current Loop NW	
TOTALS	1,581,007						

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ECO-CHARRETTE REPORT
(November, 2007)

This section documents the eco-charrette that took place at ZGF's Portland office.

ECO-CHARRETTE REPORT

THE EVERGREEN STATE COLLEGE

5.18.07

Prepared by Zimmer, Gunsul, Frasca Architects LLP

CONTENTS

1. PREFACE

This eco-charrette is part of a larger process to gather information, to understand goals, and to consider priorities during the campus master planning process for The Evergreen State College. There is a strong desire and commitment from the College faculty and student body for development and renovation plans to prioritize ecological health and sustainability as inherently fundamental to the educational mission and operation of the school. This workshop was designed to consider opportunities for the next twelve years of development that engage sustainability best practices as they relate to the unique location and site of the campus.

This report supports the mission of the team to create a visibly sustainable campus through educationally rich and proactive design, planning, and goal setting and supplements four primary goals of the Evergreen Master Plan:

1. Develop comprehensive long term capital plan for college facilities and grounds both on and off campus through a collaborative process.
2. Establish priorities consistent with the Strategic Plan of Evergreen.
3. Ensure that the plan reflects the unique qualities of the College and campus.
4. Build on the philosophical basis of past planning efforts and focus on identifying:

    Renovations and additions
    Infrastructure improvements
    Sites for potential new facilities
    Land use/landscape policies

Open feedback sessions that took place on campus as part of the first task of the Master Plan process.

2. EXECUTIVE SUMMARY

The Evergreen State College has identified sustainability, learning, and community as guiding principles for the master plan process. An eco charrette was held on May 18th to discuss sustainable design opportunities. Members of the project team and the urban design department from ZGF Architects met with university representatives and the project consultants to evaluate integrated solutions for future development.

To explore what sustainability goals mean to the campus, Evergreen formed a Sustainability Task Force whose mission is to help establish the campus as a laboratory for sustainability in operations, curriculum, and quality of life. This goal could be achieved through eight categories of impact including: 1) Curricular Pathways in Sustainability; 2) Student Participation and Education in Sustainability; 3) Resource Strategies; 4) Communication; 5) Evergreen Land Stewardship; 6) College Communities Collaboration; 7) Campus Neighborhoods, Greater Community and Region Relationships; and 8) Campus Spirit – Internal Wellness/Health. These categories framed conversations at the eco charrette.

An exercise in Strengths, Weaknesses, Opportunities, and Threats (SWOT) allowed the group to understand the institutional and regional forces that affect development on the site.

One breakout group addressed renovations, additions, and potential sites for new facilities, and another breakout group discussed infrastructure improvements, land use, and landscape policies. Out of these conversations came opportunities for integrated solutions to achieve the goals of the Sustainability Task Force and improve campus life.

With many buildings slated for renovation in the next several years, there are numerous opportunities for greening the existing building stock with retrofits like lighting upgrades, reflective paint for improved light quality, and skylight additions. Buildings can be programmed to match usage patterns so that conditioning is not required at all times. The thermal mass of the existing concrete buildings lends itself to night flushing. Future buildings can be oriented on an east and west axis for daylight and energy savings. New development will occur along the existing service tunnel to minimize infrastructure additions and encourage a pedestrian oriented main street along the main core of campus, improving public spaces like the Red Square. Increasing mixed-use development could help bridge the upper and lower zones and attract students to campus.

The upgrade of the central plant allows for new efficiencies and integration of renewable energy systems. Dual fuel boilers allow flexibility for use of biofuel in the future. Ground source heat pumps and photovoltaic panels are options for efficiencies at the building level. A broad range of energy options should be used as demonstrations for student learning and research and to support emerging technologies. With so many single occupancy vehicle trips to campus, transportation represents the campus' most significant environmental impact. This can be reduced by limiting parking, developing bike access routes from the city, and providing biodiesel shuttles. The overflow parking can become on a native meadow that serves as parking twice a year and provides ecosystem services when parking demand is low. The Reserve could be seen in a new way by establishing a naming protocol expressing the ecological and educational value of the Reserve land to the College. Stormwater can be treated on-site with bioswales that infiltrate water into the ground and also provide public amenities.

With the goals outlined by the Sustainability Task Force and expressed at the eco charrette, the development of the Evergreen campus would perform well when assessed by a metric like LEED. In the master plan, the sustainability goals will be refined into a set of criteria for development. It is often helpful to develop a set of design criteria to guide decisions and frame conversations with sustainability goals in mind.

3. INTRODUCTION

On May 18, 2007, a team of students, alumni, staff (The Evergreen State College), architects (Zimmer Gunsul Frasca Architects), consultants (Tilghman Group, Stantec and SvR), and regional resource representatives (EcoTrust, University of Oregon and the City of Portland) met for an eco charrette in Portland, Oregon to assess sustainable development opportunities for the master plan. The three Evergreen priorities for campus integration are sustainability, learning and community.

SUSTAINABILITY:

- Green commuting
- Alternative transportation
- Green/alternate energy
- Increased on-campus population
- Off-campus learning centers
- Slow foods
- Reuse and recycling
- On-site storm and wastewater management

Recycling at dormitory buildings.

LEARNING:

CENTERS:

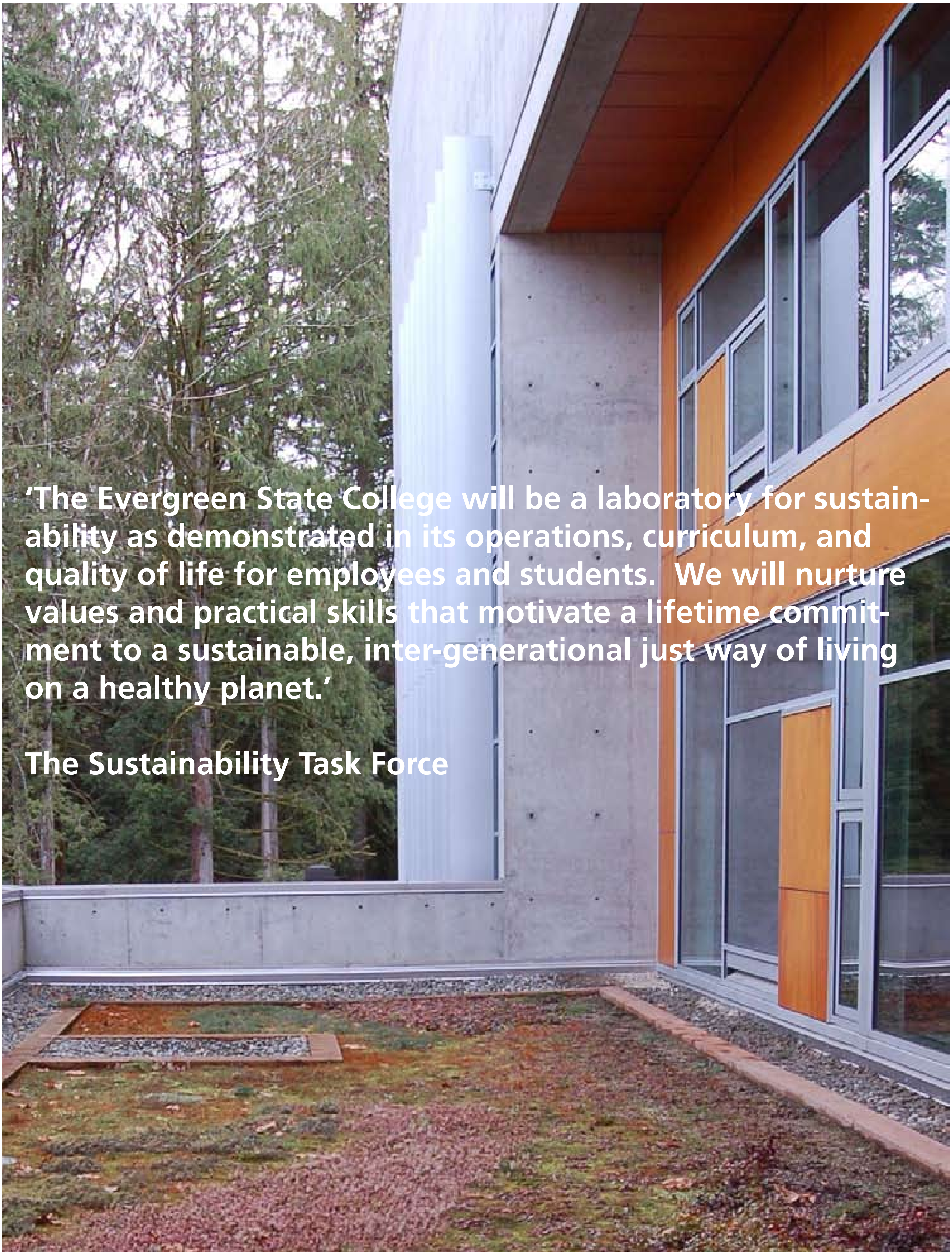
- Organic Farm
- Sustainable building practices
- Terrestrial sciences
- Stormwater systems
- Waste stream systems
- Alternative energy systems
- Campus as a laboratory
- Student/faculty research opportunities
- Focus on the right kind of learning spaces
- State-of-the-art technology

Student run Synergy Conference explores sustainability.

COMMUNITY:

- Campus as resource
- Connections/access
- Increased on-campus population
- Great on-campus places
- Strong ties to neighbors
- Leadership in innovative programs

Seminar II cafe takes advantage of its solar orientation and creates a welcoming hang-out spot.



'The Evergreen State College will be a laboratory for sustainability as demonstrated in its operations, curriculum, and quality of life for employees and students. We will nurture values and practical skills that motivate a lifetime commitment to a sustainable, inter-generational just way of living on a healthy planet.'

The Sustainability Task Force

GOALS FROM THE SUSTAINABILITY TASK FORCE

1.0 Curricular Pathways in Sustainability
1.1 Develop and implement a curriculum in sustainability
1.2 Publicize the education in sustainability at Evergreen

2.0 Student Participation and Education in Sustainability
2.1 Increase practical educational opportunities in sustainability
2.2 Increase student involvement and participation in sustainability-based planning

3.0 Resource Strategies
3.1 Promote broad adoption of best sustainable practices/purchasing successes

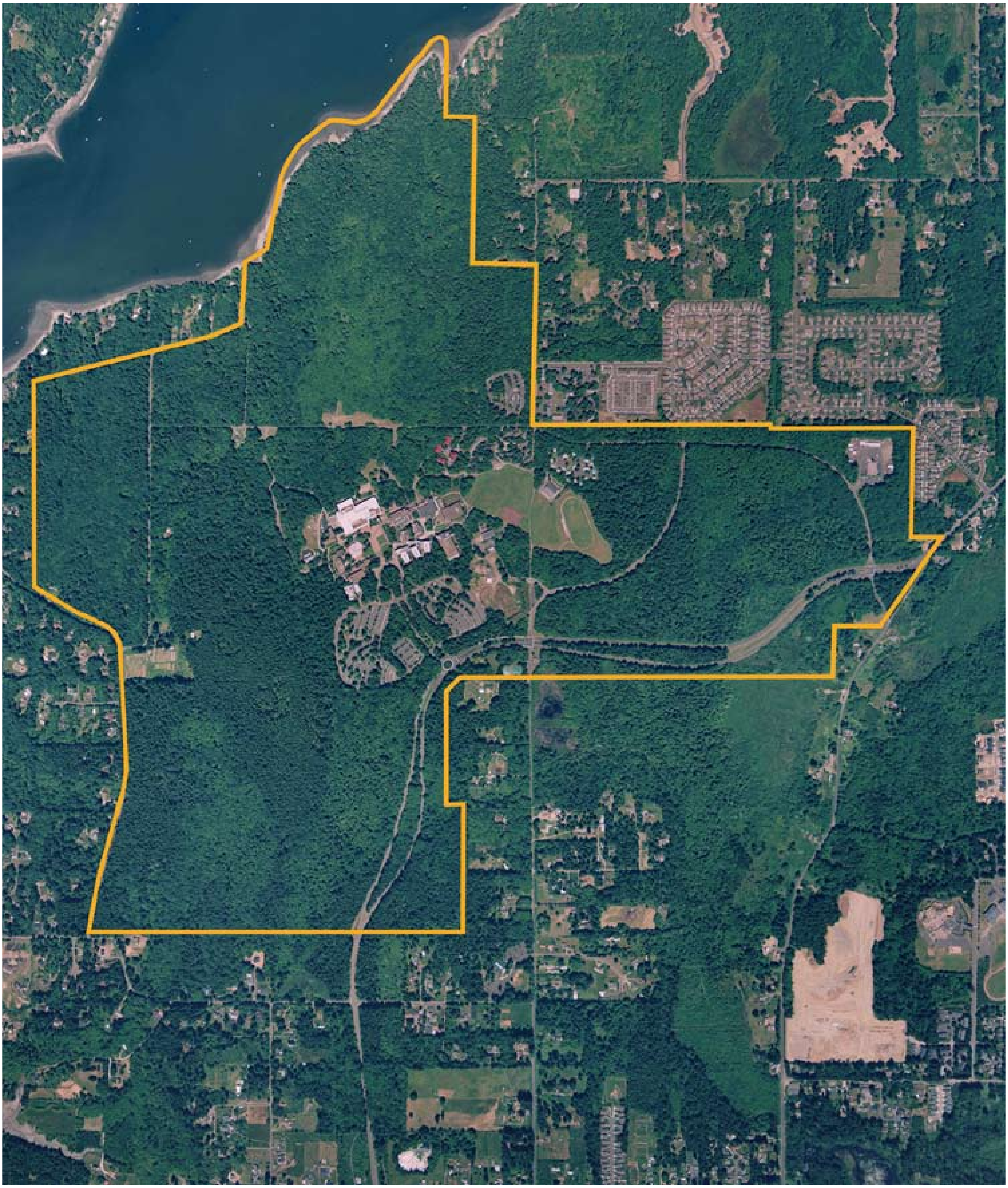
4.0 Communication
4.1 Use signage to identify sustainable features
4.2 Promote programs that educate the general public in sustainability
4.3 Promote institutional memory

5.0 Evergreen Land Stewardship
5.1 Strengthen biodiversity and ecosystem health
5.2 Develop a Land Ethic educational program
5.3 Emphasize the Center for Ecological Learning and Living
5.4 Carbon Neutrality by 2020
5.5 Significantly reduce SOV travel

6.0 College Communities Collaboration
6.1 Integrate the needs of the Tacoma and Reservation-based programs

7.0 Campus Neighborhoods, Greater Community and Region Relationships
7.1 Increase regional and national recognition
7.2 Buy local
7.3 Support cultural sustainability
7.4 Lead in ecological agriculture, gardening, and building
7.5 Promote a regional land ethic
7.6 Consult with local and regional entities on growth and sustainability

8.0 Campus Spirit – Internal Wellness/Health
8.1 Prioritize important college objectives to focus efforts
8.2 Improve community relationships and diversity
8.3 Monitor community vitality



Aerial photograph of Evergreen Campus.

4. PROJECT CONTEXT AND ECOLOGY

The Evergreen State College is located in an area that retains some rural and isolated character, but is beginning to be impacted by development in the adjacent communities. The campus is also unique in the scale, making the Reserve areas some of the only local representatives of key habitat and plant communities, which are vitally important ecological assets for the entire region.

Land use planning directly impacts water quality in the region as the College campus sits at the head of four major drainage basins. Snyder Cove Creek, Green Cove Creek, Huston Creek and an unnamed creek informally called Barking Dog Creek by the faculty. To minimize impacts to local water quality, the College has identified a desire to limit runoff by minimizing hardscape and increasing permeable surfaces. Several greenroof additions have also been installed. Further related actions have been recognized that could increase the Colleges' watershed stewardship such as the potential for stream restoration projects on campus.

Because of these unique ecological features and concern for local water quality, The Evergreen State College Master Plan has a unique opportunity to guide the campus towards becoming an even greater environmental asset and leader of sustainability in the community.

BACKGROUND

The College campus was initially conceived to accommodate as many as 12,000 students and has never exceeded 4,500, so current infrastructure is significantly oversized. This excess capacity means that current land and facility use patterns require careful reevaluation and planning in order to achieve the overall sustainable vision that meets realistic demand. The new plan considers broad opportunities that will allow the campus to make significant contributions towards balancing both carbon use and waste production and include:

- transportation modes and patterns
- energy production and use
- campus biome protection, use and enrichment
- food production
- construction practices
- waste stream management
- student life and housing

All of the investigations use sustainability as a touchstone and integrate opportunities for hands-on student learning, participation, engagement and community involvement.

With moderate student growth predicted, many buildings scheduled for renovation, and the ambitious goal to make the campus carbon and waste neutral by the year 2020, one of the challenges of the master plan is to create land use goals that maintain a healthy living environment for work, study, and play, while accommodating inevitable redevelopment demands.

The process thus far has focused on information gathering including participation of ZGF in open forums, workshops, one-on-one meetings, and tours with staff, students, and faculty on the Evergreen campus. Initial concept development includes improved circulation routes, integration of campus "centers," and preserved forest areas.

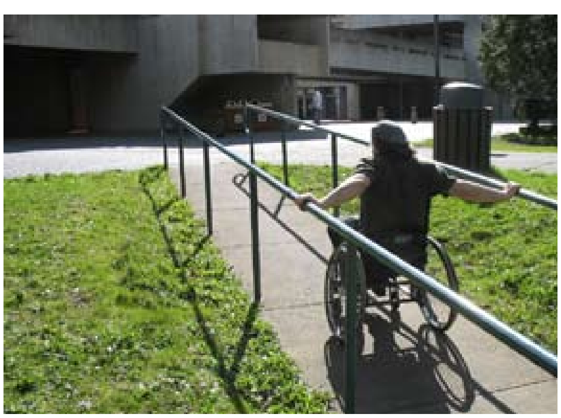
Evergreen beach on the Puget Sound.

5. STRENGTH, WEAKNESSES, OPPORTUNITIES AND THREATS ANALYSIS

An exercise to review strengths, weaknesses, opportunities, and threats (SWOT) allowed the group to understand the institutional and regional forces that affect development on the site. The SWOT analysis focuses discussion on the project's inherent strengths and weaknesses, with regard to sustainable design potential, and opportunities and threats, beyond the control of the team that impact the project's success. Strategically combining strengths and opportunities suggests an aggressive action, and combining weaknesses and threats suggests that defensive measures may need to be taken. Combining weaknesses and opportunities suggests the need to enhance project goals and to take advantage of outside support. Finally, combining strengths with threats suggests needed contingency planning for the project (and possibly some diversification of goals) if identified threats materialize.

Living machine at Clatsop Community College in Oregon.

Snyder Creek flows into Puget Sound.



ADA compliant accessible routes around campus required.

Expansion of urban growth.

Strengths

- Access to nature
- Bridge between urban and rural
- Concentrated development and abundant land
- Diverse habitat
- Contiguous Land
- Engaged student body
- Sustainability commitment and initiatives
- Wildlife stewardship
- Potential for student body to drive energy demand
- Infrastructure- Campus distribution of services
- Tidal power
- Energy savings competition- potential
- Many buildings slated for re-development creates day-light and energy efficiency potential
- Living Machine for waste water treatment

Opportunities

- Option to connect to transit via shuttle to get to services
- Connections/adjacency to four watersheds - education and leadership opportunity
- Effort to return Snyder Creek to salmon habitat
- Alumni connection to community organizations in Olympia region, energy, land use etc.
- Seasonal usage-phased operations with campus zones?
- "Super Saturday" 15 k people on campus attendees from broader community-opportunity to draw in people from the area
- "Isolation builds community"
- Provide excess capacity to community?- Power, heat etc.
- LEED Silver required by state- build sustainable infrastructure to support this
- Potential to partner with Ecotrust

Weaknesses

- Isolated campus with many SOV trips
- Opposing views about use of land
- Resistance to any development
- Lack of comfortable public spaces and student amenities
- Inflexible existing buildings, though average from an energy standpoint
- Campus design standards as a constraint
- Disconnect from local community
- Non compliant buildings- ADA? Housing accessible routes around campus
- Central plant out of date
- No monitoring of existing buildings
- Academic vision does not match reality of built environment
- No sense of connectedness- create places of community

Threats

- Commercial services distant
- Perception of reserved land as "untouchable"
- Development pressured to expand urban growth
- Boundary to campus edge
- Limited wind resource

6. BREAKOUT GROUPS

Two break out groups were formed to review sustainability opportunities relative to identified master plan goals. The groups discussed the campus and initial concepts to transform the Sustainability Task Force goals into criteria for informing the built environment of the campus.

RENOVATIONS AND ADDITIONS AND POTENTIAL SITES FOR NEW FACILITIES

EXISTING BUILDINGS:

Many of the existing buildings on campus are slated for renovation in the next few years and present an opportunity for energy savings and sustainability retrofits like improved indoor environmental quality. Lighting upgrades that could save as much as 60% of the current electricity load. Repainting with reflective colors can improve light and visibility in the rooms. Renovations offer opportunities to add skylights and open up walls to create better day light and connections to activities.

In all cases the program of the existing facilities could be enhanced by matching demand and usage patterns. Conditioning and lighting are not required around the clock for most daytime occupied classroom buildings. Rather than operating all buildings for nighttime classes, plan class schedules for efficient use of spaces. Co-locating functions and programs that can be dormant for periods of time create energy savings opportunities. In the library, for example, 20% of books are used 80% of the time. A solution could be to warehouse the vast majority of books and only condition the spaces used for display. Non-summer functions can be grouped to reduce conditioning demands on off months. The Seminar I, building for example, could be an administrative and service building for facilities.

The massive concrete form of the existing campus vernacular may lend itself to a night flushing strategy. If building uses are programmed with this in mind, and opened at night for temperature flushing, then the thermal mass may be an adequate heat sink and reduce conditioning demands during the day.

An existing building audit and survey can provide an accurate account of energy demand and alert facilities to key challenge areas. This survey could provide a baseline for comparison as retrofits occur. Because center corridors consume huge amounts of energy, when renovating, consider the width of the facility to determine if a single space can replace an otherwise double-loaded corridor to improve day light and efficiency.

Seminar I

Library Building


CAB Building


COM Building

FUTURE BUILDINGS:

Future buildings can be oriented on an east and west axis to prioritize daylight and passive solar heating and energy savings.

Future designs should focus the buildings to the "main street." Place making is a critical component of the master plan and entry points to key campus buildings can focus activity around a central courtyard and create a friendly public zone. Daylight could be harvested where reasonable and existing buildings retrofit with light wells.

An energy use threshold based on regional temperature patterns and occupancy demands provides a baseline for all new construction projects.

Potential for mixed residential and retail buildings.

Red Square could be scaled to reflect campus population more accurately.

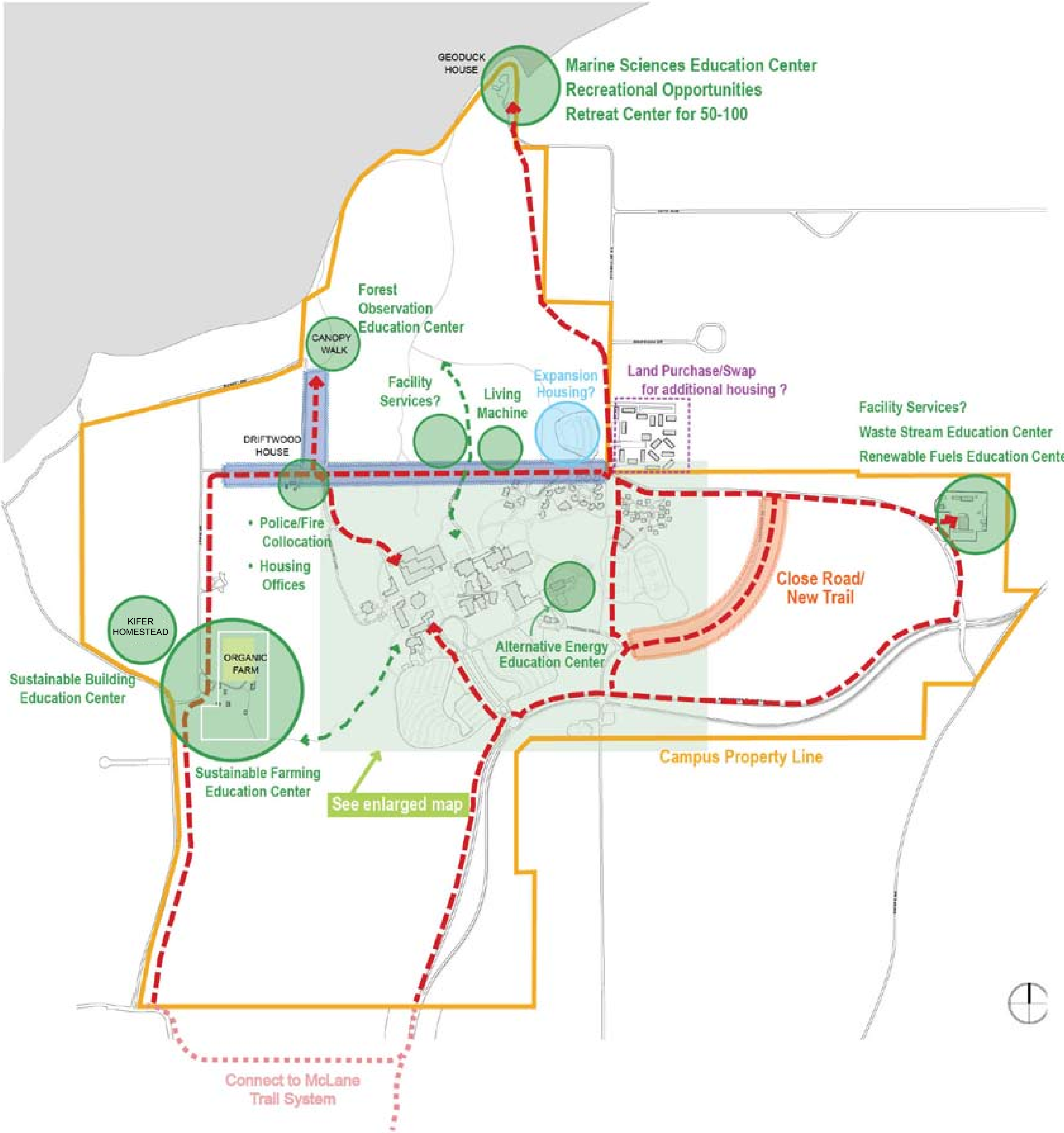
BUILDING SITES:

New development should continue along the existing service tunnel to take advantage of well defined infrastructure and limit demand for new below ground excavation. The main east west connection path demands awareness to micro climates, particularly the north side of buildings, which are challenges in the northwest. Consider pulling new facilities further back to enhance southern exposure and create great places. This further strengthens and reinforces the main street. Orientation for energy savings and daylight is essential.

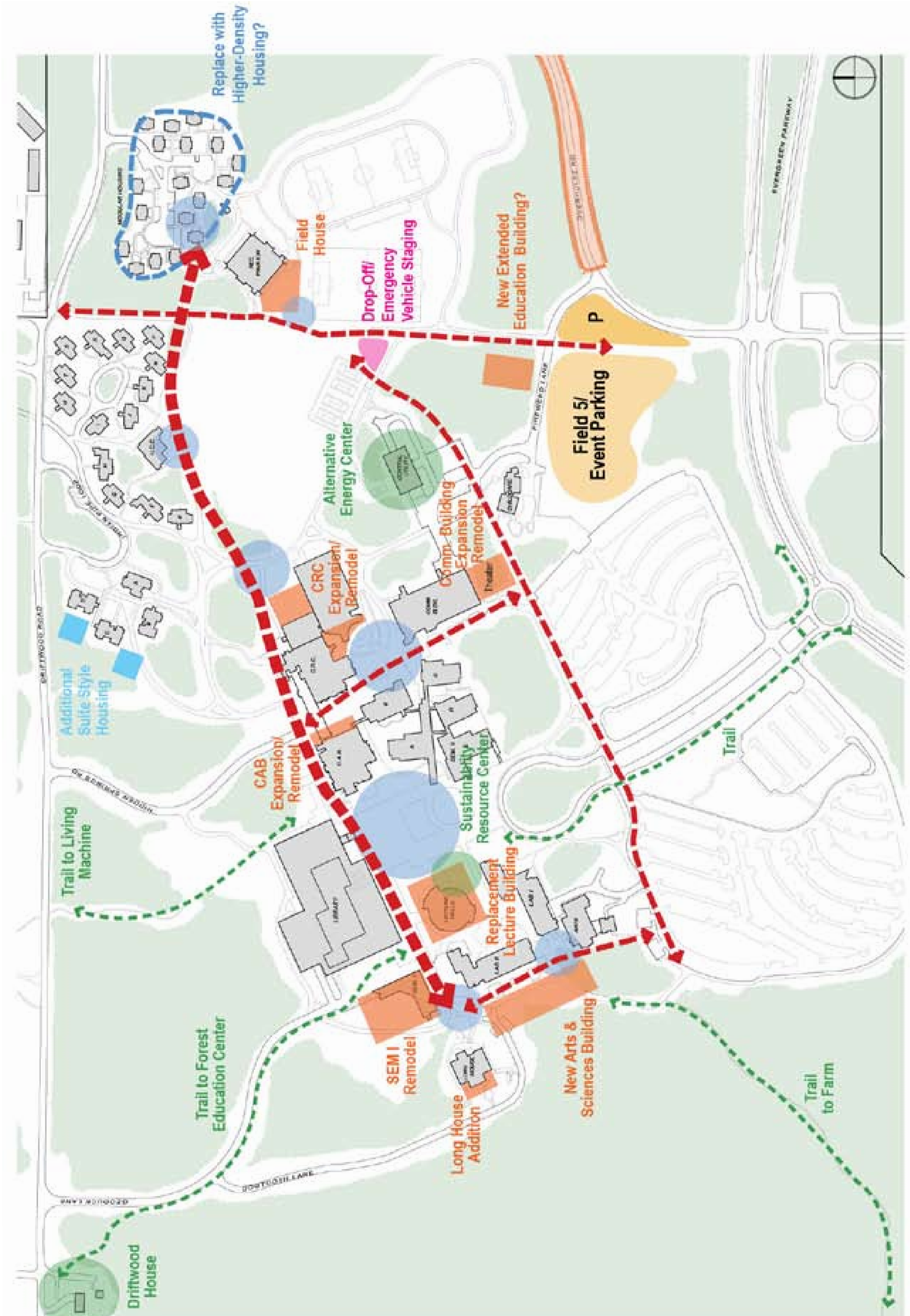
Improving the Red Square space is important to creating human centered zones and helping to define spaces between buildings. Consider adding buildings at Red Square to shape the space and provide opportunities for putting the campus teaching ethos on stage.

The Organic Farm currently has two wells which provide an opportunity for ground source heat and may be a natural building site. Increasing mixed-use development will help to bridge the upper and lower campus zones. The development of student housing should be explored to build the relationship between the academic core and existing housing. The bridge between housing and teaching/conference zones could create opportunities for living/learning buildings. Retail options should also be explored. Originally the campus perimeter seemed to be a good candidate, but with the interest in mixed use, the academic core might be a better option.

Red Square is a central zone of activity. Students hang out in front of the CAB Building.



Possible campus circulation, education centers and potential developments.



Campus Core detail.

INFRASTRUCTURE IMPROVEMENTS AND LAND USE AND LANDSCAPE POLICIES

ENERGY SYSTEMS:

The location of the Central Utility Plant (CUP) and the utility corridor which runs along the center of the campus means that a retrofit of new mechanical equipment could be easily maintained. The current equipment was also oversized to accommodate a larger campus population so much of this capacity remains dormant. The excess equipment could run at full capacity and potentially return energy to the grid. With the emphasis on the teaching potential, the plant could be transparent to show the types of energy produced. Dual fuel boilers, as in the current CUP, could be used in the redesign to provide long term flexibility for biofuels, which are currently produced on campus in small quantities. This may provide future energy security.

Ground source heat pumps are a promising option on campus and could be used at undeveloped sites with minimal landscape impact. The predicted 20 year financial payback may be offset by the potential for student learning opportunities.

The dense tree canopies limit light access to the campus and make solar panels challenging at the ground level. Rooftop surface can be retrofitted to produce energy for each building. Solar thermal hot water could provide domestic water heating for each building.

A broad range of fuel and energy sources provide visible demonstrations for student learning and flexibility with evolving advances in technology.

Energy use and systems should be visible and transparent with monitors to track savings.

Above left: Solar thermal hot water and wind turbines are an economical and environmentally focused energy solution.
Above Right: Waste to energy system.

TRANSPORTATION:

For maximum reduction of environmental footprint, a key focus of the master plan must be reduction in single occupancy vehicle trips to campus. Evergreen can work with the city on a number of measures that would significantly improve the accessibility of the campus by bike or shuttle. Since many students live off campus, a simple biodiesel run shuttle could bring students to campus running in a continuous loop. Improved bike routes from downtown and creation of a non-stop path, that is well lit and safe, would make the route more appealing. The money typically paid for parking would go towards these efforts. The large parking lot currently marking the entrance to campus could be replaced with a more welcoming visual statement. Because this lot is primarily used for overflow purposes like graduation and festivals that attract city residents to the campus, parking could be moved to another location that functions as a bi-yearly parking lot and a wild planted meadow all other days. This has the advantage of decreasing the visual prominence of parking and preserving the existing lot for future development while providing a parking lot that continues ecosystem services. By increasing the cost of parking on campus, students would be discouraged from driving and encouraged to take advantage of alternative means. The main route to campus could become a visible transit corridor that is an attractive route and tells a story of Evergreen's sustainability commitment as student and campus visitors approach it from the city.


A planted parking lot at Willamette Park, reduces runoff and promotes water quality.


Bike and pedestrian connections could be made to the McLane Trail system adjacent to the campus.

Side door to campus.

LANDSCAPE OPPORTUNITIES:

The extensive vegetated acres of Evergreen's campus are a unique resource. With Evergreen's commitment to carbon neutrality by 2020, the greatest asset of the second growth forest is to sequester the carbon emitted by regular campus operations in a kind of closed loop environment. The other opportunity is the existing infrastructure of artesian wells that could potentially provide water for irrigation.

The value of the landscape may lead to community partnerships, on-campus attraction, and ecosystem services that benefit the surrounding neighborhood.

Big leaf maples are prominent in the Reserve.

Biofuels can continue to be produced on-site and in greater quantities to power a biodiesel shuttle on campus or the dual fuel boilers in the central plant. This biodiesel production facility requires sufficient space for operation.

One approach to help convey the value of the Reserve is a naming protocol in which the different services of the forest are expressed. This may draw from the cultural and tribal connections of the land and provide protections through historical context.

Community gardens near the housing could support sustainable practices like on-site production of organic produce.

Stormwater can be treated on-site with bioswales that infiltrate treated water back into the ground or on-site collection basins that store water for irrigation.

Seminar II building uses bioswale technology for storm water management.

The Evergreen State College Organic Farm produces biofuels on-site.

7. RELEVANT ASSESSMENT CRITERIA

Throughout the design and development process, it is helpful to select a metric or filter to assess sustainable design decisions and focus the design on the overarching sustainability aspirations of the project. Evergreen may choose to use an industry-wide standard or develop unique design principles. The industry standards applicable to a master plan are limited, but with the rapidly changing nature of the green building industry, other metrics for assessment will likely become available in the future. As part of the master plan document, a set of Evergreen-specific sustainability principles may be derived from the eco-charrette. There are a few existing frameworks that could be applied to the project and have been explored briefly.

LEED CAMPUS APPLICATION GUIDE

Leadership in Energy and Environmental Design (LEED) is a third party rating system created by the US Green Building Council that has become the industry standard for what makes a green building. Washington State now requires LEED Silver for publicly funded buildings. LEED evaluates buildings in five primary impact categories: 1) Sustainable Sites; 2) Water Efficiency; 3) Energy and Atmosphere; 4) Materials and Resources; and 5) Indoor Environmental Quality. Success is based on a 69 point rating system in four threshold rankings: certified, silver, gold, and platinum. LEED has a campus application guide to support use of LEED credits for multiple buildings on a campus, which may be a good fit for Evergreen. The rating system has some limitations for the large undeveloped area on the campus, because it is primarily focused on developed land and does not provide guidelines for broader ecosystem services of the on-site forest lands. Based on the goals set forth in the eco-charrette and identified by the Sustainability Task Force, Evergreen buildings could perform well when assessed by the LEED framework.

LEED plaque displayed on Seminar II Building.

LEED FOR NEIGHBORHOOD DEVELOPMENT

Another LEED standard currently in its pilot phase is LEED for Neighborhood Development. This standard was designed primarily for urban, mixed-use neighborhoods that include residential, retail, and commercial components. Given some of the priorities discussed at the charrette, like promoting mixed-use on the campus to attract more students to residential life, the neighborhood development standard might be a good fit. The standard is based on 106 points over the same five impact categories and receive one of four threshold ratings of: certified, silver, gold, and platinum.

Green Roof Institute in Augustenbord; bioswales provide educational opportunities and environmental solutions.

THE NATURAL STEP

The Natural Step is a framework for assessing sustainability that can be applied on any level from a product to an entire city. It is a systems based approach to solve problems in a way that avoids new problems and develops core values within a framework for social and ecological sustainability. It is an appropriate means to evaluating a master plan because it looks broadly at impact and resource flows. The Natural Step defines sustainability based on four principles or conditions that must all be met. An evaluation of a building or campus based on The Natural Step must not increase 1) concentrations of substances extracted from the Earth's crust; 2) concentrations of substances produced by society; or 3) degradation by physical means; and 4) in that development, people are not subject to conditions that systematically undermine their ability to meet their own needs. Use of The Natural Step as a metric for assessing sustainability on the Evergreen campus requires significant analysis and commitment to meeting these identified goals, and would demand this rigor at every step of design. There is no performance assessment associated with this rating.

EVERGREEN SUSTAINABILITY CHARTER

Building a new framework may be appropriate for Evergreen at this stage in planning for the future. ZGF can help develop a campus charter or working set of sustainability criteria to clarify the goals identified in this report and frame them to guide decisions in the future. ZGF has created similar charters for healthcare master plans and a similar structure would work well for an educational campus. These documents help build consensus to help everyone involved understand priorities. This effort would build on the goals and missions identified by the Sustainability Task Force and transform them into a set of criteria that relates to sustainability in the physical environment. It would require close collaboration between ZGF and Evergreen to draft an initiative that is specific enough to be useful, but broad enough to apply to a range of development.

LDS Conference Center, greenroofs on campus can help to manage stormwater.

8. NEXT STEPS AND TASKS

One of the primary goals of an eco-charrette is to prioritize analysis and next steps associated with some of the opportunities discussed. Because these ideas are only as effective as their follow through, it is important to incorporate certain milestones into the project schedule. The opportunities and goals discussed at the eco-charrette have already been incorporated into the team's thinking and process as they move forward with the master plan. Implementation of these goals can establish the college's commitment.

Above: A salmon habitat restoration project.

PROGRESS

- Student groups on campus are currently working to gather existing utility data, which will be used to set benchmarks for retrofit improvements. Included in these calculations will be quantifications of current carbon emissions and energy consumption by fuel type.

- The eco-charrette established a partnership between the project team and Ecotrust to provide GIS information and analyze the Reserve to help inform decisions along the way. This process will quantify ecosystem services provided by the site and allow preservation plans to be created.

- Accurate weather data and microclimate information should be used to inform orientation of buildings and location of outdoor public spaces. In addition, this information would provide insight to programming for new buildings and reprogramming of existing buildings to ensure that spaces are used to their full capacity when demand is high and allow buildings that are not used during summer months to remain unconditioned.

- Ecotect modeling is being used to inform building orientation and incident radiation on-site.

- The Reserve areas will be preserved through a naming protocol that creates positive associations with the identified areas.

- The location of student housing will be studied to encourage more mixed use and collocation of services to make campus living more appealing while reducing the number of vehicle trips to campus.

- Further conversations with the City of Olympia and Thurston County are essential to develop partnerships to design and implement an integrated transportation plan that will improve bike access from the city and surrounding communities to campus.

- Further exploration of a college funded shuttle service would increase access to campus for students who live in the city and resident students who need to get into town.

- In order to fund these projects, the team is developing the idea of environmental offsets that allow students to offset negative environmental actions through purchases from the university that create a pool of funds for sustainability improvements. For example, a student could purchase an offset for air travel from the College for airfare, the funds from which build a fund for buying biodiesel or electric vehicles for the college fleet.

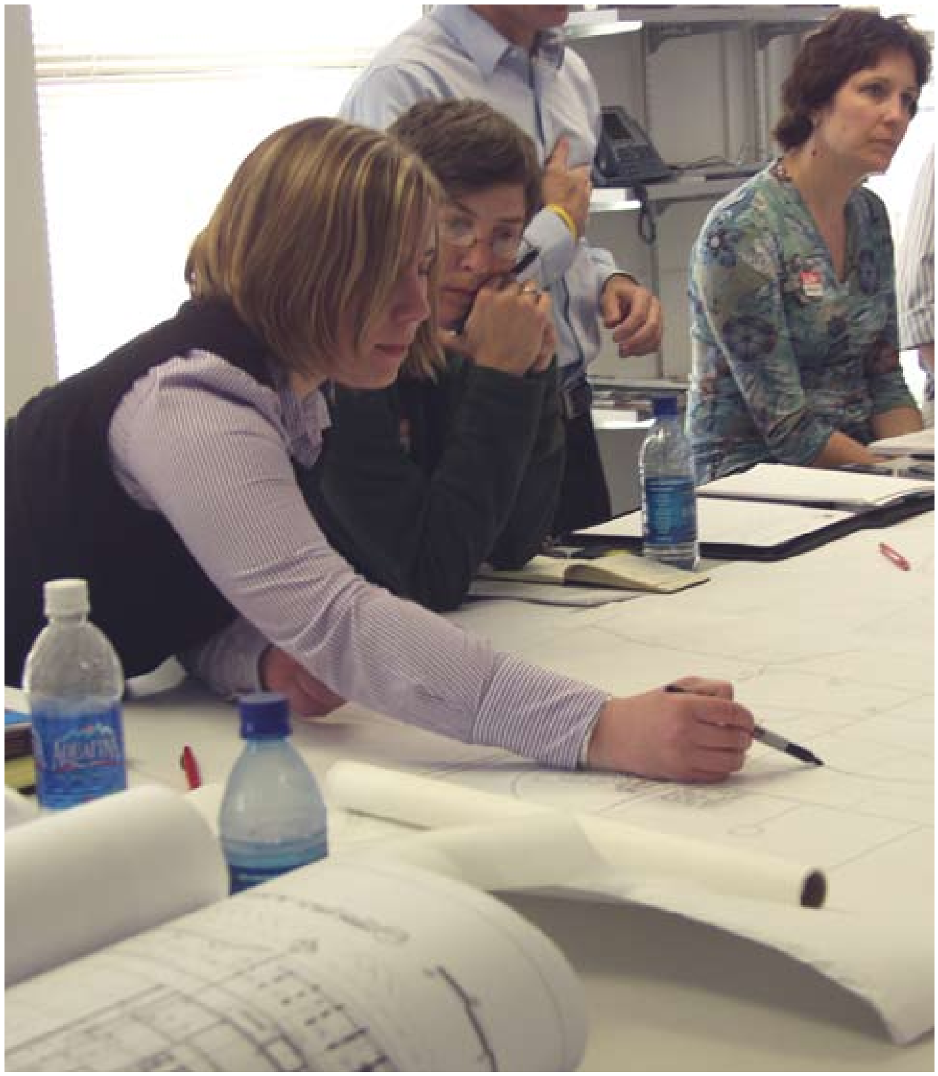
PROJECT SCHEDULE (INCLUDE TASKS WITH THIS TIMELINE)

JUNE 2007
Sustainability Task Force
Planning Committee
Senior Management
Trustees Meeting

JULY - SEPTEMBER 2007
Submit Preliminary Draft
Plan Development
Update Preliminary Draft
Feedback Sessions on Campus

OCTOBER 2007
Submit Draft Document

NOVEMBER 2007
Document Updates
Submit Final Document



Above: Breakout group discussing campus landscape initiatives.

9. APPENDIX

WORKSHOP AGENDA

THE EVERGREEN STATE COLLEGE ECO-CHARRETTE AGENDA

May 18, 2007

GOAL:

To develop strategies for creating a Sustainable Campus with implementable, challenging and forward thinking concepts to achieve the values of the Sustainable Campus Mission Statement.

1:00-1:30

1.0 Introduction
1.1 Attendees (Naomi/Johanna)
1.2 Project (Tim)
1.2.1 Site and existing conditions
1.2.2 Master plan mission and goals
1.2.3 Ideas to date

1:30-2:00

2.0 SWOT Analysis (Naomi/Johanna)
2.1 Frame forces in play for project development
2.1.1 Strengths and weaknesses internal to institution
2.1.2 Opportunities and threats from external community

2:00-2:15

3.0 Sustainable Campus Missions (Naomi)
3.1 Eight categories identified by the Sustainability Task Force

2:15-3:45

4.0 Discussion Groups
4.1 Group 1 (facilitated by Johanna and Tim)
4.1.1 Renovations and additions
- What criteria should inform how and where additions are planned?
- How can we best leverage the existing building stock to serve the needs of the campus over the next 10-15 years?

4.1.2 Potential sites for new facilities
- What are the most important criteria for locating new building sites?
- Which sites offer the best opportunities for building in a sustainable manner?

4.2 Group 2 (facilitated by Naomi and Don)
4.2.1 Infrastructure Improvements
- Which model for the renovated central plant makes the most sense?
- What are the best reconfiguration options for campus circulation systems – pedestrian, service, bus and car?
- How can the plan encourage greater use of bikes, buses and other alternatives to the SOV?

4.2.2 Land use and landscape policies
- How can the Plan best protect the reserve from inappropriate development?
- Can/should the Plan also be leveraged to protect adjacent habitat that is contiguous with the Evergreen reserve?
- How can the reserve actively contribute to the college's sustainability goals?

3:45-4:15

5.0 Synthesis and Discussion (Naomi/Johanna)
5.1 Group 1 reports
5.2 Group 2 reports
5.3 Shared lessons

4:15-4:30

6.0 Next Steps and Follow Up (Naomi/Johanna)
6.1 Tools for analysis, decision-making, benchmarking
6.2 Potential incentives and strategic partnerships
6.3 Project schedule and integration of sustainable goals

ATTENDEES

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SUSTAINABILITY FINANCING

FEDERAL INCENTIVES

Energy Policy Act of 2005
$1.80/SF for 50% efficiency increase of whole building or
$.60/Sf for 16 2/3% efficiency for unique building system

Business Energy Tax Credit (BETC)
Through end of 2008, then reduced
30% credit for solar, solar hybrid lighting, and fuel cells, and 10% for mircoturbines

Renewable Electricity Production Incentive
Tax credit of 1.9 cents per kilowatt hour
Electricity generated by renewable energy resources including solar, wind, geothermal, closed-loop biomass.

LOCAL INCENTIVES

Washington Renewable Energy Production Incentives
$0.12/kWh - $0.54/kWh depending on technology type and where equipment was manufactured
Incentive capped at $2.000/year

Washington Biofuels Production Incentive
Awards low-interest loan and grants for research and development of renewable energy sources, including infrastructure, facilities, and technologies that will advance Washington's move towards energy independence.

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CARBON NEUTRALITY BY 2020: THE EVERGREEN STATE COLLEGE COMPREHENSIVE GREENHOUSE GAS INVENTORY

(2007)

Thesis by Master's of Environmental Studies student John F. Pumilio.

CARBON NEUTRALITY BY 2020:

THE EVERGREEN STATE COLLEGE'S

COMPREHENSIVE GREENHOUSE GAS INVENTORY

by

John F. Pumilio

A Thesis: Essay of Distinction
Submitted in partial fulfillment
of the requirements for the degree
Master of Environmental Studies
The Evergreen State College
June 2007

This Thesis for the Master of Environmental Studies Degree

by

John F. Pumilio

has been approved for

The Evergreen State College

by

____

Rob Cole
Member of the Faculty

____

Date

ABSTRACT

Carbon Neutrality by 2020:
The Evergreen State College's
Comprehensive Greenhouse Gas Inventory

John F. Pumilio

This study provides the results of The Evergreen State College's comprehensive greenhouse gas inventory. In light of the latest scientific research on the issue of global warming and in response to recommendations made by the Sustainability Task Force, The Evergreen State College committed to carbon neutrality by 2020 as specified in the 2006 updated Strategic Plan. Furthermore, in January 2007, Evergreen President Les Purce joined the Leadership Circle of the Presidents Climate Commitment agreeing to achieve "climate neutrality as soon as possible." I conducted Evergreen's comprehensive greenhouse gas inventory as an essential step of these new climate policies in order to begin the process of tracking Evergreen's emissions over time. I followed the protocol established by the Clean Air-Cool Planet Campus Carbon Calculator. Evergreen's gross greenhouse gas emissions were 19,870, 21,671 and 22,112 metric tonnes for the years 2004, 2005, and 2006, respectively. In all three years, Evergreen's single largest source of emissions came from purchased electricity. Electricity use combined with space heating and commuter habits accounted for over 90% of total emissions for each of the three years. Partially offsetting emissions, Evergreen's forest ecosystem and composting facility sequesters less than 800 tonnes of carbon dioxide per year. Based on these results, achieving net-zero emissions (by reducing gross emissions and/or increasing rates of sequestration) is highly improbable in the foreseeable future without the purchase of offsets from the retail carbon market. Therefore, I recommend that The Evergreen State College achieve carbon neutrality sooner (by Fiscal Year 2009), rather than later (Fiscal Year 2020) through the purchase of high quality retail carbon offsets. Most importantly, Evergreen should commit to specific and incremental greenhouse gas reduction targets. I recommend the following goals: 1) reduce 2006 emissions 15% by 2012; 2) reduce 2006 emissions 40% by 2020; and 3) reduce 2006 emissions 80% by 2050.

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~ ACKNOWLEDGEMENTS ~

Covering a topic as large as global warming and completing a comprehensive greenhouse gas inventory with no previous training would have been an impossible feat without the help of many people in the Evergreen community. First and foremost, I want to thank Evergreen faculty member and my thesis reader Rob Cole. One afternoon, while having lunch, Rob convinced me of the importance and value of taking on this project. In the months that followed, Rob was instrumental in helping me get through the inevitable "roadblocks" that accompany a project such as this. I particularly enjoyed his directness, enthusiasm, and knowledge on the topic – this led to several engaging and insightful conversations.

If not for the assistance of Paul Smith (Director of Facilities) and Rich Davis (College Engineer), I would not have been able to acquire the enormous amount of data within the necessary timeframe. I am grateful for the time they spent with me and their willingness to add this project to their list of responsibilities.

Special thanks to Evergreen's Sustainability Task Force who recognized the importance of establishing an aggressive climate policy and maintained the perseverance to see it become reality. I am especially appreciative of Nancy Parkes and Steve Trotter who co-chair the Task Force. Over the past few years, Nancy taught me more about the concept and practice of sustainability than she will ever know. Steve reminded me that nothing can replace face-to-face communication; a lesson easily forgotten in today's world of email and cell phones. Moreover, Steve always made time to discuss the history and current state of Evergreen and his experience provided great insight into institutional planning. He has a gift for knowing how to get things done. Overall, working with Steve helped me develop great care and appreciation for the Evergreen community. I owe both Nancy and Steve a world of thanks.

I want to personally thank Evergreen President Les Purce who has taken a regional and national leadership role on the issue of climate change. Our discussions regarding sustainability and climate change helped me to better understand these issues from the perspective of executive planning.

Finally, many Evergreen community members provided me with important data for the inventory. Thanks to Karina Anderson (Facilities), Melissa Barker (Manager Organic Farm), Laura Coghlan (Institutional Research), Daniel Duncan (Parking Services Intern), Jennifer Dumpert (Travel Office), Dylan Fischer (Faculty Member in Forest Ecology), Clifford Frederickson (Accounting), Mark Kormondy (Facilities, Grounds), Jenni Minner (Institutional Research), Sherry Parsons (Facilities, Motor Pool), Ed Rivera (Facilities, Specialist), Susie Seip (Parking Services), Craig Ward (Food Services, Aramark), and last but not least to Lisa Bellevue, Evan Griffith, Alexandra Kazakova, Jake Kirby, Justin Kirsch, Guy McGuire, and Alexandra Stefancich who were students in this years Introduction to Environmental Studies program. Their excellent work and survey data contributed greatly to my thesis work.

PREFACE

Global warming has seen a hundred years of scientific investigation, decades of congressional hearings, and nearly 20 years of international scientific collaboration, however, no other time has changed the debate like this past year. In 12 short months global warming has come to dominate the national conversation and the vast majority of Americans are no longer wondering whether human activities are driving global warming. Instead, they are wondering how severe the impacts are going to be and what we are going to do about it. In response to this meteoric rise in public awareness, many companies, local governments, organizations, and institutions have enacted self-imposed climate policies. Most, like the U.S. Mayors Climate Protection Agreement, are commitments to reduce greenhouse gas emissions by a certain percentage by a certain date (i.e. 7% below 1990 levels by 2012). Others, like The Evergreen State College, are striving for carbon neutrality. For most Americans, the tide has shifted and business-as-usual is no longer acceptable policy.

In an attempt to capture this sudden shift in national sentiment and awareness, I have divided this thesis into two parts. Part I will examine how Americans have suddenly come to terms with the fact that the issue of global warming will not go away and must be dealt with. Chapter 1 will take a close look at the science behind global warming and investigate how scientists understand global warming to be an "unequivocal" fact, that it is "unprecedented" in at least the past 1300 years, and how anthropogenic greenhouse gas emissions are the main driving force behind our current warming trend. Chapter 2 will concentrate on both the global and regional impacts of climate change. Much of this chapter will be devoted to the current and projected impacts of global warming to Washington State. Chapter 3 will retrace a history of inaction around the issue of anthropogenic climate change and support my argument as to why any further delay to reduce greenhouse gas emissions is dangerous and irrational.

Part II will bring the global and national issue of climate change home by detailing the events that led to The Evergreen State College's commitment to reduce greenhouse gas emissions (Chapter 4) and the necessary decision to complete Evergreen's comprehensive greenhouse gas inventory. Chapter 5 will help the reader understand the basic concepts and calculations of any carbon inventory and my decision to use the protocol established by Clean Air-Cool Planet (a New Hampshire based organization that partners with college campuses all over North America to help reduce greenhouse gas emissions). Chapter 6 will detail the approach I took in gathering the necessary institutional data in order to complete the inventory. Chapter 7 details my step-by-step decision-making process and calculations behind Evergreen's greenhouse gas inventory. This chapter is essential reading for anyone interested in conducting Evergreen's next greenhouse gas inventory or for anyone interested in the results of the inventory for the years 2004-2006. Finally, Chapter 8 will peer into the future and ask, "where does Evergreen go from here now that the inventory results are in?" While Evergreen's effort to reduce greenhouse gas emissions must involve thoughtful community dialogue and well-reasoned decision-making, in Chapter 8 I will provide my personal recommendations on what I believe Evergreen's next steps ought to be.

PART I

COMING TO TERMS WITH GLOBAL WARMING

CHAPTER 1

Climate Change – An Anthropogenic Effect

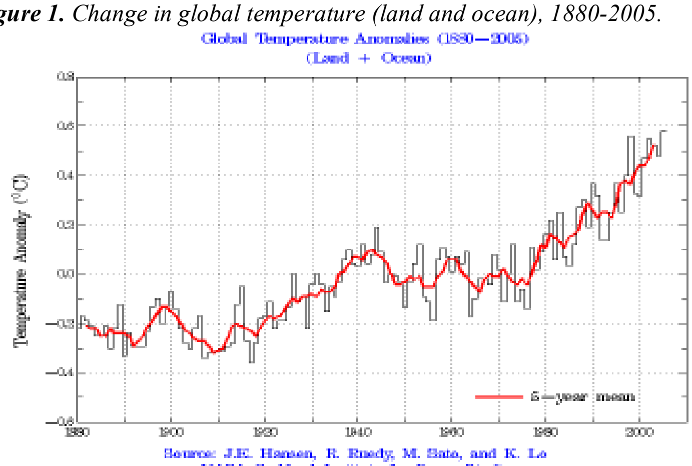
I. Global Warming: An Unequivocal Fact

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air temperature and ocean temperatures, widespread melting of snow and ice, and rising global mean sea-level."

IPCC, Fourth Assessment Report, Working Group I, 2007

According to the 2007 Fourth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC), it is an "unequivocal" fact that Earth's temperature is rising. Humans have been witness to this change and it is well documented. Since 1850, the average global temperature has risen 0.74 degrees Celsius (IPCC, 2007b). However, this warming trend has not been evenly distributed. The rise in temperature (for both the United States and the world) has been accelerating at a rate approximately three times faster over the past 30 years than it did during the rest of the 20th century (Figure 1) (NOAA, 2007b). More significantly, eleven of the past twelve years have been the warmest in recorded history (IPCC, 2007b). And, according to the National Oceanic and Atmospheric Administration (NOAA), 2006 was the warmest year ever recorded in the U.S. and our annual average temperature is now approximately 1.0 degrees Fahrenheit warmer than it was at the turn of the century (NOAA, 2007b). Because this warming trend has been gradual, up until the last few years, the scientific community and especially the general public have been slow to reach consensus that our planet is warming.

Figure 1. *Change in global temperature (land and ocean), 1880-2005.*



As late as 1985, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) – after their conference in Villach, Austria – concluded that global warming was a serious *possibility* (Houghton & Woodwell, 1989). One year later, the National Aeronautic and Space Administration (NASA) and the WMO issued a three-volume report with much stronger wording. They agreed that climate change was not only taking place but that it was happening at a relatively rapid rate (Porter, Brown, & Chasek, 2000). In 1995, the Intergovernmental Panel on Climate Change released their Second Assessment Report indicating that Earth's temperature had increased by 0.3 to 0.6% over the past 100 years.

Air temperature is not the only indicator that our planet is heating up. Our oceans absorb more than 80% of the heat added to the climate system (IPCC, 2007b). Consequently, oceans have not only been warming up on the surface, but the warming has increased to at least 3000 m in depth (IPCC, 2007b).

Taken altogether, there is no longer any doubt that the Earth is warming and that the rate of warming is increasing, but how significant is a 0.74 degree C rise in temperature in the span of a hundred years? Is it unprecedented or typical of a natural pattern? Answering this question is critical, because it can help reveal what may be causing this change, whether it is threatening to life as we know it, and what (if anything) can be done about it. In order to answer these questions and put the recent warming trend in perspective we need to have a historical understanding of global temperature change. That is, knowledge of global temperatures extending far beyond human records. Here lies a challenge: how can scientists know, with any kind of precision, what global temperatures were like hundreds, thousands, or hundreds of thousands of years ago? Incredibly, the answer lies (in part) in the very substance vulnerable to warming itself: glacial ice.

II. The Paleoclimatic Record: Glacial Ice Reveals an Unprecedented Warming Trend

"Recent record high hemispheric temperatures are probably unprecedented in at least 1200 years. Twentieth Century global warming is a reality and should be taken seriously."

Jonathon Overpeck, Director, NOAA National Climatic Data Center

Researchers have been drilling cores of ice out of Greenland and Antarctic ice sheets since the late 1960s (NASA, 2005). These cores of ice contain archived information on the chemical composition of Earth's atmosphere in the form of tiny air bubbles. These air bubbles are ancient and incredibly important because scientists have the ability to precisely age them. This deserves a brief explanation.

In the polar regions, there is a difference between summer and winter snow. In the summer, incessant sun causes changes in the texture and composition of the snow and this snow is distinct from the winter snow that falls under dark, cold skies (NASA, 2005). The difference in these seasonal snowfalls causes an annual layer in the ice. By drilling and removing ice cores, researchers can count the number of layers, and by counting back from the present, can estimate the year that each layer was formed.

By the early 1990's, scientists had pulled a nearly 2-mile-long core of ice out of both the Greenland Ice Sheet and the Vostok Ice Sheet in Antarctica (Lorius et al., 1990; NASA, 2005). The tiny air bubbles contained within each layer represented over 110,000 and 750,000 years of atmospheric information, respectively (NASA, 2005).

As one would expect, these air bubbles contain atmospheric oxygen. Oxygen comes in different isotopes including "light" oxygen (^{16}O) and "heavy" oxygen (^{18}O). As it turns out, determining the ratio of these oxygen isotopes ends up being a remarkably accurate predictor of air temperature from a long time ago (Gore, 2006). More specifically, cooler air causes water molecules with ^{18}O to condense and precipitate at a greater ratio than ^{16}O. This condensation and precipitation happens at lower latitudes and by the time air reaches the poles it has become depleted of ^{18}O (NASA, 2005). Therefore, oxygen from polar ice cores with a low ratio of ^{18}O reveals lower global air temperatures. This is just the type information needed to put Earth's current warming trend in perspective. The Vostok ice core in particular has been extremely valuable because its 750,000-year record transcends a complete glacial-interglacial cycle.

Data from these ice cores (along with a multitude of other proxy data[1]) have confirmed that there have been both warmer and cooler periods relative to today. For example, during the last interglacial period (about 125,000 years ago), polar temperatures were approximately 3 to 5 degrees C warmer than today (IPCC, 2007b). And only 18,000 years ago (at the height of the Last Glacial Maximum) temperatures were cooler

[1] Proxy data include a suite of climatically sensitive indicators that reveal past changes in global climatic patterns. Examples, of proxy data include tree ring width, preserved pollen grains, oxygen isotopes, ice texture, fossils, marine sediments, etc.

than present (Lorius et al., 1990). Understanding what caused this estimated 5 degree C fluctuation in temperature is critical because it may shed light on what causes global climate change and why global warming is happening today.

Remarkably, these glacial and interglacial periods coincide fairly well with the astronomical theory of ice ages. The astronomical theory suggests that the beginning and ending of ice ages is ultimately the result of the interplay between the Earth's orbit and aspect in relation to the sun. There are three main factors: 1) the changing shape of the Earth's orbit around the sun (eccentricity) which is a 100,000 year cycle; 2) the changing tilt of the Earth's rotation axis (obliquity) which is a 44,000 year cycle; and 3) the changing "wobble" of the Earth's axis (precession) which is a 23,000 year cycle (Keller, 2003). The interrelationship between these patterns and their resulting radiative forcing[2] is commonly known as the Milankovitch Cycle (Schneider, 1997).

The question now before us is whether or not the Earth is at a period in the Milankovitch Cycle that is the root cause of our current warming trend. In other words, in terms of the Milankovitch Cycle should Earth be getting warmer or cooler? The answer is cooler. According to the Milankovitch Cycle, solar forcing began increasing around 20,000 years ago and peaked around 10,000 years ago (Pielou, 1991). Therefore, over the past 10,000 years, solar forcing should be decreasing (or negative) and the Earth should be experiencing an overall cooling trend. The paleoclimatic record agrees. We know that our latest glaciation (the Last Glacial Maximum) peaked around 18,000 years ago. At that time, our planet began to warm and Earth's huge continental ice sheets began to recede. In North America, for example, the Laurentide and Cordilleran ice sheets (which together covered most of Canada and the northern half of the U.S.) began melting away and eventually disappeared. We also know that we should be entering our next glacial period and that average global ice coverage should be increasing.

However, as with all things related to climate, nothing is this straightforward. In other words, the Milankovitch Cycle by itself cannot and never has completely explained Earth's prevailing climate pattern. Numerous "other" climate forcings such as volcanic eruptions, water vapor, CO_2 levels, cloud properties, the eleven-year sunspot cycle, etc. superimpose themselves over the general pattern of the Milankovitch Cycle. As a result, actual climatic patterns vary from what is predicted from the Milankovitch Cycle alone.

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[2] Forcing refers to any variable that may influence global temperatures. Examples include, carbon dioxide, solar radiation, aerosols, etc. A positive forcing tends to cause a warming affect while a negative forcing has a cooling affect.

The Medieval Warming Period (890 to 1170) and the Little Ice Age (1300 to 1850) offer two prime examples. And, the paleoclimatic record from the past several hundred thousand years also confirms this. At first, original reconstructions of Earth's past climate cycles from the Vostok ice core showed a "strong" correlation between the Milankovitch Cycle and global temperatures (Lorius et al., 1990). However, a more recent reevaluation of the data demonstrated that there was a "mismatch" in the one hundred thousand year cycle (Rind, 2002). More specifically, the warming trend ended before the astronomical forcing predicted it would. This "mismatch" is not limited to ice cores. Oxygen isotope data from sediment, corals, and more recently from Devils Hole Cave in Nevada suggest that the glacial termination event was virtually completed 135,000 years ago (Karner & Muller, 2000). This is approximately 10,000 years before solar forcing began according to the Milankovitch Cycle. Furthermore, it has also long been realized that the Milankovitch Cycle is inconsistent with more rapid and shorter-term climate events that have been well documented in ice cores (Lorius et al., 1990). In other words, interrelated climate forcings (other than solar radiation) have a powerful influence over global temperature.

None of this, of course, implies that the Milankovitch Cycle is wrong. On the contrary there is considerable evidence supporting the astronomical theory and the influence that solar forcing has over glacial periods (Rind, 2002). What paleoclimatologists are telling us, however, is that global temperatures are not solely influenced by anyone factor (including the Earth's rotation and tilt as it relates to the sun). The dominant theory of today suggests that solar forcing is the ultimate decider over the start and end of ice ages while other forms of climate forcings amplify or overshadow this affect at smaller temporal scales (Rind, 2002).

Ultimately, what this boils down to is that the Milankovitch Cycle deals with time scales too large and patterns too broad to provide much insight into what is causing Earth's recent and comparatively short-lived temperature surge. For this reason, scientists have been forced to narrow their focus to relatively modern time periods (within the past couple of thousand years) where data is more universal and more reliable. Within this timeframe, ice cores taken from thick mountainous glaciers throughout the world (including the Mendenhall Glacier in Alaska, Mt. Kilimanjaro in Tanzania, as well as glaciers in the Himalayas and Andes Mountains) become a source of extremely valuable data. After decades of intense ice core research, spanning all of these various geographic locations, paleoclimatologists have learned a great deal about climatic patterns within the past several thousand years.

At this temporal scale, it becomes obvious that Earth's current warming trend is highly unusual. The scientific community is in near consensus that the late 20th century warming is "unprecedented" (Jones & Mann, 2004). In a study of the paleoclimatology of the Northern Hemisphere, Osborn and Briffa (2006) concluded that the warming event that has taken place within the past 50 years is more widespread and of greater significance than any other climatic event that has taken place within the past 1200 years (Osborne & Briffa, 2006). And, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007) concluded that average Northern Hemisphere temperatures during the late 20th century are likely higher than any other 50-year period in at least the past 1300 years. This means that our current warming trend is even more significant than the Medieval Warming Period. More significant, not only because average temperatures are greater today, but also because the MWP was mainly limited to Europe and the North Atlantic while our current warming is global in nature. Moreover, scientists have ruled out the simple explanation that our current warming pattern is a "recovery" from the Last Glacial Maximum or even the Little Ice Age (which ended in the mid-1800's) (U.S. National Assessment Synthesis Team, 2001).

In summary, it is now obvious and with a high degree of scientific certainty that Earth's current warming trend is taking place at a level and at a rate that is unnatural and unprecedented in recorded human history.

III. The Facts Are In: Anthropogenic Greenhouse Gas Emissions are Very Likely the Cause of Global Warming.

"The understanding of anthropogenic warming and cooling influences on climate has improved since the Third Assessment Report (TAR), leading to very high confidence[3] that the globally averaged net effect of human activities since 1750 has been one of warming."

IPCC, Fourth Assessment Report, Working Group I, 2007

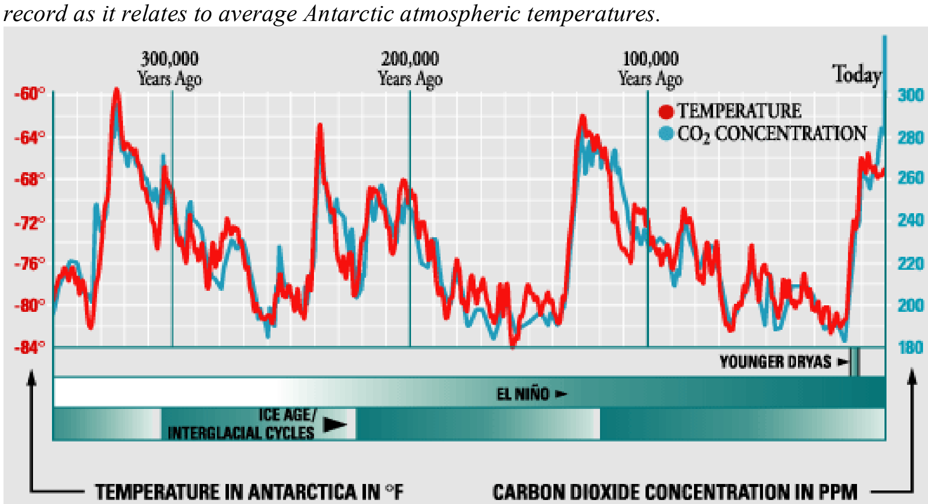
Now that we have established "unequivocally" that the Earth's temperature is rising and that this warming trend is likely "unprecedented" in at least the last 1300 years

[3] *Very high confidence* is defined by the IPCC as having at least of 90% chance of being correct.

it is critical to know why. Knowing why can help us better understand how long the warming may continue and how intense it could get.

Over the past several decades the number one public debate in the global warming controversy is whether or not human activities are causing today's warming trend. The circumstantial evidence that humans may be causing global warming has long been known and is irrefutable. Scientists have long understood the direct relationship between levels of atmospheric greenhouse gases (i.e. water vapor, carbon dioxide, ozone, methane, nitrous oxide, etc.) and global temperatures. Figure 2, for example, shows the direct relationship between atmospheric levels of carbon dioxide and Antarctic temperatures. Furthermore, because humans are adding concentrations of GHGs to Earth's atmosphere through the combustion of fossil fuels and certain land use activities, it is entirely plausible that humans are contributing to global warming. However, without scientific measurements we can never fully understand the degree to which we our affecting our planet's climate.

Figure 2. *Levels of atmospheric carbon dioxide as determined from the Antarctic ice core record as it relates to average Antarctic atmospheric temperatures.*



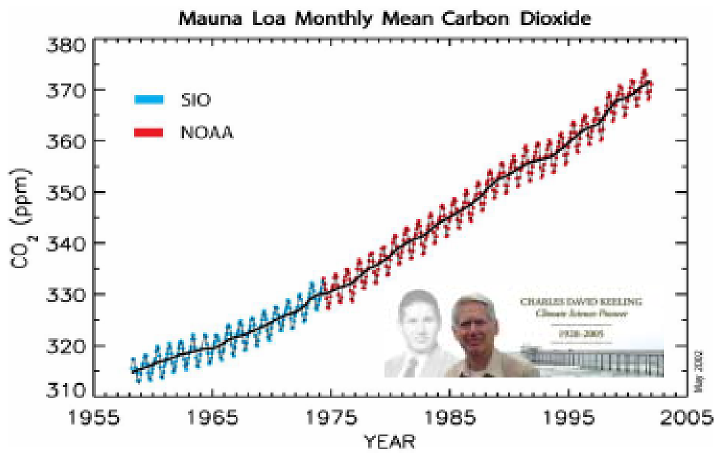
Source: Koshland Science Museum

From a scientific perspective, it is difficult to precisely measure how AGHG emissions are impacting global temperatures. There are two major reasons for this: 1) climate fluctuates regardless of human activities, therefore, scientists attempt to tease out the human effect in order to better understand potential impacts; and 2) atmospheric greenhouse gas composition also naturally fluctuates regardless of human activities. It is worth remembering that the greenhouse effect occurs naturally and is necessary to life as we know it. Greenhouse gases play an essential role in Earth's overall heat balance: they trap radiant heat that would otherwise pass through Earth's atmosphere back into space resulting in an overall warming effect. This natural greenhouse effect is relatively well understood. Water vapor is the most powerful of the GHGs contributing approximately 60% to the natural greenhouse effect. Carbon dioxide contributes another 25% while ozone, methane, nitrous oxide, and clouds make up the rest. Without these gases, climatologists estimate that the average global temperature would be negative 18 degrees C causing the surface of the Earth to be covered in snow and ice (U.S. National Assessment Synthesis Team, 2001). Paleoclimatologists have enlightened us to the fact that fluctuating levels of naturally occurring GHGs have had profound consequences on Earth's past climate regime.

Because Earth's climate naturally fluctuates and because composition of naturally occurring greenhouse gases also naturally fluctuates, it is challenging for climatologists to decipher the anthropogenic effect of our planet's current warming trend. In order to help simplify matters, climatologists have focused on one greenhouse gas in particular: carbon dioxide. Carbon dioxide is a natural choice not only because human activities directly add it to the atmosphere, but also because it has a larger overall greenhouse effect than the other major AGHGs (ozone, methane, and nitrous oxide) (Lorius et al., 1990). For these reasons, climatologists are more interested in CO_2 levels than on any other GHG.

As early as 1904, Swedish scientist Svante Arrhenius, was studying the effect that doubling atmospheric CO_2 would have on global climate(PBS:_Science_&_Health, 2005). And in the 1950's, famous climatologist Roger Revelle understood the potential implications of the world's dependence on fossil fuels as it relates to global warming. He worried that, "Within a few centuries we are returning to the atmosphere and oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years…" (Revelle & Suess, 1957). More importantly, Revelle understood the necessity of measuring CO_2 levels in order to verify and quantify the possible anthropogenic effect. He hired Charles David Keeling to begin measuring CO_2 from the Mauna Loa research station on the big island of Hawaii. From Mauna Loa, atmospheric CO_2 has now been measured continuously since 1958. In 1958, the atmospheric concentration of CO_2 was just over 310 parts per million (ppm). Atmospheric CO_2 levels have steadily increased over this time and in 2005 they measured 381 ppm (Gore, 2006). The nearly 50 years of measurements from the top of Mauna Loa have produced the famous "Keeling Curve" the most widely recognized graph in all of climatology (Figure 3).

Figure 3. *The "Keeling Curve." Atmospheric carbon dioxide levels as recorded from the Mauna Loa research station on the big island of Hawaii.*



Through this direct measurement we now know that there has been a rise in atmospheric CO_2. However, is a 70 ppm increase in 50 years significant? Once again, to put this increase in perspective, scientists look to the paleoclimatic record. The same tiny air bubbles from the same ice cores used to measure oxygen isotope ratios are also used to measure CO_2 levels and other GHGs. The results are alarming. These ice cores have revealed that for hundreds of thousands of years the composition of Earth's atmosphere has been relatively consistent. Then, starting around the time of the Industrial Revolution (about 150 to 200 years ago), levels of carbon dioxide along with methane, nitrous oxide, and sulfur dioxide all increased (Schneider, 1997).

Methane levels, for example, have risen about 150% since the Industrial Revolution and this is most likely due to an increase in the spread of global agriculture and mining activities (Schneider, 1997). In 2005, the global atmospheric concentration of methane was 1774 parts per billion (ppb) (IPCC, 2007b). This remarkable increase from pre-industrial levels (about 715 ppb) is well above the natural range (320 to 790 ppb) of the last 650,000 years as determined from ice cores (IPCC, 2007b). The Intergovernmental Panel on Climate Change concludes with 90% certainty that the global rise in atmospheric levels of methane is a direct result of anthropogenic activities (IPCC, 2007b). Since methane is 23 times more powerful as a greenhouse gas than CO_2, its levels must also be closely watched (EPA, 2006b).

Nitrous oxide is another GHG whose levels have increased. According to the Intergovernmental Panel on Climate Change, global nitrous oxide levels have increased about 18% from a pre-industrial value of 270 parts per billion (ppb) to 319 ppb in 2005 (EPA, 2006b; IPCC, 2007b). The Intergovernmental Panel on Climate Change estimates that more than a third of all nitrous oxide emissions are anthropogenic in nature caused by a rapid increase in the global use of nitrogen fertilizers (IPCC, 2007b; Schneider, 1997).

However, for the reasons mentioned above, CO_2 levels are of the greatest interest and are also the most alarming. The rate at which humans have been adding CO_2 to the atmosphere is astonishing. In the United States alone, researchers estimate that deforestation, agricultural practices, and the combustion of fossil fuels have increased levels of atmospheric carbon by roughly 35% since 1750 (EPA, 2006b). This increase should not be surprising when one realizes that since 1750 the U.S. has taken over 400 gigatonnes of carbon (GtC) from the biosphere and added to the atmosphere (U.S. National Assessment Synthesis Team, 2001)). This pattern is not unique to the United States but is found throughout the world especially in the industrialized north. A global estimate by the U.S. Department of Energy places 305 billion tons of carbon into the atmosphere from the burning of fossil fuels since the start of the Industrial Revolution (Marland, Boden, & Andres, 2006). Not surprisingly, global levels of atmospheric carbon have skyrocketed. Pre-industrial levels of atmospheric CO_2 fluctuated around 280 ppm and at no point in the past 650,000 years did levels exceed 300 ppm (Gore, 2006). As illustrated in Figure 2, we can now see that levels have surged to approximately 381 ppm. This data is not controversial. Former vice president and presidential candidate Al Gore, who was a former student of Dr. Revelle, expresses this clearly and succinctly, “There is not a single part of this graph – no fact, date, or number – that is controversial in any way or in dispute by anybody” (Gore, 2006).

The fact that CO_2 concentrations are directly correlated to warmer global temperatures, that humans are emitting over 25 million tons annually of CO_2 into the atmosphere (EIA, 2006), and that current CO_2 levels have exceeded anything seen within hundreds of thousands of years is quite convincing that human activities are in some way responsible for today’s global warming. In fact, modern state-of-the-science climate models conclude that natural forcings are not enough to explain today’s warming trend

(Zwiers & Weaver, 2000). Only anthropogenic forcings can account for Earth's rising global temperatures. As a result, the 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report profoundly changed the debate by concluding, with 90% certainty, that the rise in global temperatures since the mid-20th century is caused by anthropogenic emissions of GHGs (IPCC, 2007b).

IV. Chapter Summary

In summary, we have seen that it is an unequivocal fact that global warming is happening, that our current warming trend is unprecedented in at least the past 1300 years, and finally, that we can no longer reasonably question whether humans are responsible for today's global warming. The next logical step is to consider what the potential impacts of anthropogenic warming may be. This will be the focus of the next chapter.

CHAPTER 2

Impacts of Anthropogenic Warming

"Humanity's influence on the global climate will grow in the 21st century. Increasingly, there will be significant climate-related changes that will affect each one of us."

U.S. National Assessment Synthesis Team, 2001

As discussed in the previous chapter, we know that global warming is a reality and that only anthropogenic greenhouse gas (AGHG) emissions can explain the unprecedented rise in average global temperatures during the past 50 years. The next logical question to consider is what the impacts of global warming may be. This should be a main focus of policymakers, scientists, and the general public in the months and years ahead.

Society needs to understand the potential consequences of global warming for two predominate reasons: 1) to judiciously decide what priority global warming should be given on the list of threats and challenges facing modern-day civilization, and 2) understanding the severity of global warming impacts allows societies to weigh the risks associated with addressing the problem against the risks associated with global warming itself. In other words, decision-makers and citizens need to ask, "Are the consequences of global warming going to outweigh the risks associated with sufficiently reducing GHG emissions?"

So, what are the potential consequences of global warming? How widespread will they be? Will you be personally affected by global warming? When will these impacts occur and how severe will they be? The objective of this chapter is to answer these questions. I have organized it into two parts: 1) global and U.S. impacts of climate change and 2) impacts of global warming for the Northwest focusing on Washington State.

I. Global and U.S. Impacts of Climate Change

"At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones."

IPCC, Fourth Assessment Report, 2007

Unquestionably, climate change is a global issue. This is true for two specific reasons. First, anthropogenic greenhouse gas emissions do not remain in the place where they are emitted (impacting that place and nowhere else). In other words, CO_2 molecules emitted from a factory in Seattle can drift halfway around the world within weeks and remain in the atmosphere for over one hundred years contributing to climate change in every part of the world. Second, no one is isolated from the consequences of global warming. Today's unparalleled level of globalization virtually guarantees that any significant event happening in one part of the world will have ripple effects throughout. Whether it is a gradual collapse of a regional agricultural industry, the displacement of entire communities living along a flooded coast, or a powerful hurricane that slams into America's Gulf Coast, the effects can be felt nationwide and in some cases worldwide. Hurricane Katrina, for example, struck land several thousand miles away from Washington State yet drained millions of dollars from our local economy due to a surge in oil prices (Sightline Institute, 2006). The point is, the sustenance of cultures and economies are highly dependent on resources and labor that cross national and continental boundaries. Because no one is immune from the consequences of global warming, every nation and every individual must take it seriously. These are two of the reasons why climate change is a global issue.

As emphasized in the previous chapter, we know that global temperatures have risen 0.74 degrees C since the 1850's and that the rate of warming has significantly increased over the past 50 years. What have the impacts been? In other words, what discernable consequences have paralleled these warmer temperatures and what can we expect in the future?

~ Melting & Thawing ~

Melting Sea Ice. Let us start with a seemingly obvious expectation. One would expect that warmer temperatures would result in an average reduction of global ice cover. Has this happened? The answer is yes. According to the latest U.S. Climate Change Science Program report (2006), perennial Arctic sea ice has declined 9.8% per decade in area since 1978. And, since 2002, satellite images have revealed a 1.3 million km^2 reduction in area of Arctic Sea Ice (double the size of Texas) (U.S. Climate Change Science Program, 2006). The thickness of the sea ice is also affected. An estimated 40% reduction in volume has occurred since the 1950s (Diaz, 2006). This trend is expected to continue well into the future for both the Arctic and Antarctic regions. In fact, some projections predict that by the end of the 21st century, Arctic late-summer sea ice will almost entirely disappear (IPCC, 2007b). This reduction in sea ice is threatening the arctic ecosystem (most notably the polar bear population) and the subsistence lifestyle of northern indigenous peoples.

Melting Polar Ice Sheets and Alpine Glaciers. Continental ice sheets are also affected. Greenland contains the Northern Hemisphere's largest ice sheet. It is about 1.7 million km^2 in area or nearly the size of Mexico (U.S. Climate Change Science Program, 2006). Over the past 15 years, approximately 105 million acres in area of this ice has melted (Arctic Climate Impact Assessment, 2004). But this only tells part of the story. The Greenland ice sheet is also 3 km thick in some areas and what it is losing in volume every year is even more revealing. The U.S. Climate Change Science Program estimates that approximately 162 km^3 (39 mi^3) of volume reduction has occurred in Greenland every year since 2002 (U.S. Climate Change Science Program, 2006). Earth's other pole is experiencing similar affects. The Antarctic Ice Sheet – the largest reservoir of fresh water on the planet – is losing an estimated 150 km^2 of ice every year (Velicogna & Wahr, 2006). And over 1,000 mi^2 of the Larsen Ice Shelf (on the Western Antarctic Peninsula) have melted (Diaz, 2006). Of course, melting ice is not limited to the poles. Most people are familiar with the disappearing glaciers at the summit of certain famous mountains such as Mt. Kilimanjaro. But the effect is pandemic. Today, an estimated 90% of the world's alpine glaciers are receding (Landler, 2006). This is striking, because as recently as 1980 approximately 75% of these same glaciers were advancing.

Rising Sea-Level. Should we be alarmed at this sudden change in course of the world's glaciers? Once again, the answer is yes. The rate and volume of landlocked ice melting into freshwater is substantial and this has consequences for the human race. One consequence is a rise in sea-level. The U.S. National Assessment Synthesis Team (2001) estimates that global sea-level has risen 4 to 8 inches throughout the 20th century. And, the rate is increasing. Since 1993, the average rise in sea-level has been 3.1 mm per year compared to 1.8 mm per year from 1961 to 1993 (IPCC, 2007b). Thus far, the problems associated with this rise in sea-level have been local, but should this trend continue we could expect widespread problems in the form of human displacement and mass migrations. The reason being, a large percentage of the world's population lives along the coast. Nearly 70% of the worlds population lives within 100 miles of the ocean and approximately 50 million people currently live at risk of coastal flooding and storm surges (Diaz, 2006). In the U.S., the problem is no better – more than half of the population lives within 50 miles of the coast (NOAA, 2007a). The fact is, if even a portion of our planet's coast becomes inundated it would cause enormous social and economic disruption. Where will all of these people go and how is this going to impact the communities they settle into? Furthermore, coastal areas are hubs of commerce, home to corporate headquarters, and serve as essential ports of trade (NOAA, 2007a). Not to mention that some of humanities most affluent development exists along the waterfront.

The question now before us is will sea-level continue to rise and how far will it go? Once again, the past provides a key to the future. The last time arctic temperatures were comparable to today's temperatures for an extended period was 125,000 years ago. At that time, sea-level was 12 to 18 feet higher (IPCC, 2007b). In fact, sea-level will continue to rise. There are two very straightforward reasons why. First, CO_2 is long-lived with a residence time of over a century (Keller, 2003). This means that the CO_2 released into the atmosphere today will still be there in 2100. Because the rate of global CO_2 emissions continues to increase at a rate of about 1% per year (Karl & Trenberth, 2003), we know that atmospheric levels of CO_2 will continue to do the same and for many decades to come. Second, climate change from CO_2 emissions has a delayed reaction. In other words, even if global CO_2 emissions were stabilized today, we know that Earth's atmosphere will continue to warm as it reacts to the CO_2 already in the atmosphere (Karl & Trenberth, 2003). For these two reasons, even conservative estimates predict that by 2100 the Earth's temperature will be 2.4 degrees C (4 degrees F) warmer than today (U.S. National Assessment Synthesis Team, 2001). According to James Hansen (NASA's chief climate scientist at the Goddard Institute for Space Studies), the last time atmospheric temperatures were that warm sea-level was approximately 80 feet higher than today (Time Magazine, 2006).

Air temperature is not the only factor accounting for a rising sea-level. Warmer ocean temperatures cause an expansion of water molecules also resulting in sea-level rise. Therefore, even if the amount of freshwater running into the ocean somehow stabilized, sea-level would still rise due to thermal expansion alone. The 2007 Intergovernmental Panel on Climate Change report states that an expanding ocean will continue for many centuries to come due to the delayed time it takes to vertically transport heat from the surface into the deep ocean (IPCC, 2007b).

To be sure, glacial recession and the thermal expansion of the ocean will continue and so will a rise in sea-level. By some estimates, sea-level could rise three feet by the end of the century and continue to rise for centuries (Karl & Trenberth, 2003; U.S.

National Assessment Synthesis Team, 2001). Some coastal communities are already taking action. The residents of Shishmaref, Alaska, for example, have recently voted in favor of spending $100 million to pick-up and move their entire town inland to escape coastal erosion and flooding (Diaz, 2006).

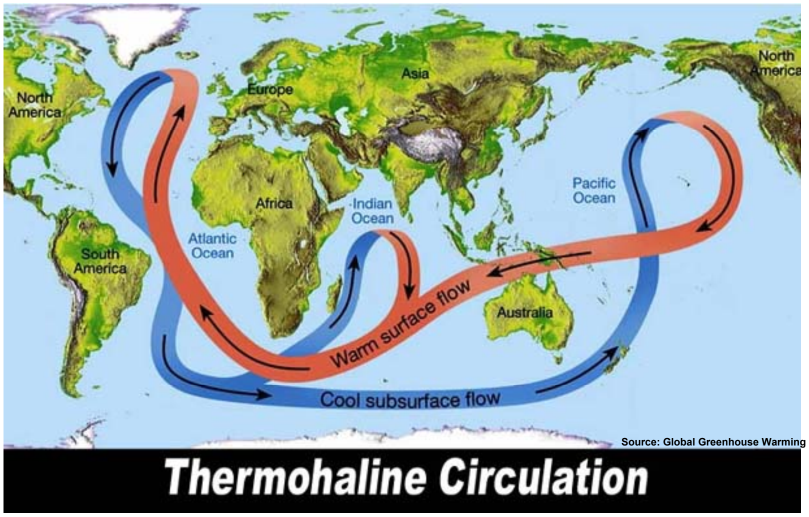
It is important to note that future estimates of sea-level rise are conservative. The Intergovernmental Panel on Climate Change, the U.S. National Assessment Synthesis Team, and the U.S. Climate Change Science Program do not account for the potential catastrophic collapse of huge ice shelves in either Greenland or Antarctica. If this were to happen, the affect would be sudden and severe. For example, if the Western Antarctic ice sheet were to suddenly collapse, global average sea-level would increase by approximately 18 feet (Diaz, 2006). This would submerge huge portions of Florida (including the Florida Keys), Bangladesh, the Marshall Islands, and many other islands and coastal areas (Diaz, 2006). James Hansen guarantees that these ice sheets will collapse if the world continues with a business-as-usual scenario. Hansen also believes that "sea-level rise is going to be the big issue soon, more even than warming itself (Hansen, 2006)."

Decline in Global Fisheries. Mass migrations and property damage are not the only problems associated with the melting of Earth's glaciers. The huge volume of freshwater rushing into mid and high latitude oceans have caused an overall decrease in ocean salinity (IPCC, 2007b). Additionally, there is a direct relationship between the amount of atmospheric CO2 and acidification of the world's oceans. Average ocean surface acidity has already increased since pre-industrial times and this trend is expected to rise at a greater rate during the 21^{st} century (IPCC, 2007b).

As these trends continue we need to consider how this will affect the ocean's ecosystem. Warming ocean temperatures, a rapid change in ocean salinity, and increased acidification will further exacerbate the depletion of today's overexploited fish stocks. Putting economic losses aside, commercial fisheries provide 40% of the human population with its source of dietary protein (Diaz, 2006).

Disruption of Global Ocean Currents. One truly frightening scenario is the possible shut down or disruption of the Global Ocean Conveyor Belt (Figure 4).

Figure 4. Diagram of the Global Ocean Conveyor Belt.



This interconnected global circulation of ocean water is fundamental to our planet's overall climate and nutrient cycling. The Gulf Stream portion (in the North Atlantic) of the Global Ocean Conveyor Belt, for example, is responsible for the relatively warm temperatures in Western Europe. Officially, it is called the Atlantic Meridional Overturning Circulation. It is a classic thermohaline circulation: thermo for temperature and haline for salinity. It is the combination of temperature and salinity that makes this Global Ocean Conveyor Belt possible. However, the warming of the ocean's temperatures coupled with its changing salinity (from the invasion of freshwater from the melting Greenland Ice Sheet) threaten to shut down the Gulf Stream portion of the Conveyor Belt. This happened at the end of the last ice age (around 10,000 years ago), and when it did, Europe slipped back into its own ice age for approximately another 1,000 years (Gore, 2006; U.S. Climate Change Science Program, 2006). If this were to happen today, the consequences would be nothing short of a global catastrophe. The 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC, 2007b) concludes – with near certainty – that the Atlantic Meridional Overturning Circulation will slow down during the 21st century. Fortunately, the Intergovernmental Panel on Climate Change report also concludes that the possibility of a large abrupt shutdown of the Global Ocean Conveyor Belt during the next 100 years is remote (IPCC, 2007b). However, when faced with consequences as severe as the shutdown of the

Global Ocean Conveyor Belt, pre-emptive action should be taken seriously (no matter how remote the possibility).

Thawing Permafrost. Ice also exists in the form of permanently frozen ground known as permafrost. And, as expected, warmer global temperatures are reducing the total land area covered by permafrost. Since 1900, the area covered by permafrost in the Northern Hemisphere has decreased by 7% (IPCC, 2007b). Alaska provides a well-documented case study of the problems caused as permanently frozen land begins to thaw. Permafrost underlies 85% of Alaska and the discontinuous permafrost – found in the central and southern part of the state – has experienced significant thawing. As this permafrost thaws, the land subsides in some places and heaves in others causing infrastructure damage to roads, airports, homes, and other forms of development. Current damage to Alaska's infrastructure is costing the state approximately $35 million annually (U.S. National Assessment Synthesis Team, 2001). Similar to melting ice, the problem is going to get worse as global temperatures continue to rise. For example, in central and southern Alaska, the top 30 feet of permafrost is likely to thaw by 2100 (U.S. National Assessment Synthesis Team, 2001).

People may take comfort knowing that permafrost, found in the northern reaches of the Northern Hemisphere, exists where few people do. However, the consequences of thawing permafrost are far reaching. Alaska's North Slope, for example, provides America with nearly one-quarter of its domestic oil supply. This oil is delivered to the lower 48 by the 800-mile long Trans-Alaska pipeline. The pipeline was built to handle some ground instability, but future increased maintenance costs due to the thawing of the permafrost is likely. If the pipeline's support structures fail, it would cost roughly $2 million per mile to replace them (U.S. National Assessment Synthesis Team, 2001).

From an ecological standpoint, the disappearing permafrost also has global consequences. Permafrost regions support vast areas of wetlands: the frozen ground prevents infiltration of melting snow and ice. As a result, water becomes locked on the surface creating globally important wetlands during the spring and summer. These places create critical breeding habitat for migrating birds (especially waterfowl). If the subsurface thaws and these wetlands disappear, the consequences will be far reaching for ecosystems throughout the Northern Hemisphere.

Melting Snowpack. Of course, warmer global temperatures not only melt ice, but snow as well. Since the 1960s satellite data has revealed about a 10% decrease in global snow cover (Diaz, 2006). As more wintertime precipitation comes in the form of rain and ice rather than snow, the snowpack is dwindling. This is troubling because there is less springtime snowmelt to refill reservoirs for human consumption and use. Inevitably, if this trend continues it will exacerbate already contentious water rights issues.

~ Extreme Weather Events ~

Extreme weather events are also a source of significant concern. As tropical sea surface temperatures increase so does the intensity of tropical cyclone activity in the North Atlantic. According to the Intergovernmental Panel on Climate Change's latest assessment report, there is observational evidence to support that this has already happened since the 1970's and more severe hurricanes are likely to become more frequent in the future (IPCC, 2007b). Additionally, the El Nino Southern Oscillation (ENSO) events have been more severe, more frequent, and longer lasting in the past 30 years when compared to the previous 100 years (Berliner, 2003). To be sure, the effects of El Nino are global with varying regional impacts. One particularly problematic effect of El Nino occurs along the Pacific coast of the Americas. Here, the normally cold, nutrient-rich ocean currents fail causing a break down in the food chain. This has enormous impacts on the marine ecosystem and commercial fishing industries in this part of the world. Furthermore, heavy precipitation events go hand-in-hand with El Nino causing significant flooding, landslides, and infrastructure damage. In fact, heavy precipitation events have significantly increased over most land areas since 1900 while at the same time more intense and longer droughts have been observed throughout the tropics and subtropics since the 1970s (IPCC, 2007b). This is another example of extreme and highly variable weather patterns correlated with global warming. Of course, all of these trends are expected to not only continue but increase in frequency and severity as global warming continues.

~ Extinction & Loss of Biodiversity ~

Conservation biologists are reaching consensus that anthropogenic climate change is going to have severe ecological consequences. Understanding the problem is rational enough. Long-term warming temperatures, changing water regimes, longer droughts, disappearing sea and glacial ice, thawing permafrost, changing wind patterns, and more extreme weather patterns are profoundly changing the biosphere. Inevitably, this is and will continue to impact ecosystems around the world as living organisms try to keep pace with these changes. The specific question on the mind of most conservation biologists' is, "how are ecological communities going to adapt to a rapidly changing climate?" Vastly altered plant and animal communities, the spread of invasive species, increasing rates of extinction, and the widespread loss of ecosystem services are the main concern. I am going to cover each of these, briefly, below.

Let us start with altered plant and animal communities. There is a common misconception that as the Earth continues to warm, ecosystems will migrate northward, intact. Those adhering to this belief, envision today's ecological communities still existing in their integrity, but simply moving higher in latitude or higher in altitude. This over simplistic view will be the exception rather than the norm. It rarely happened during the warming period following the end of the last glaciation and it is even more unlikely to happen in today's world. Paleontologists, especially those who specialize in the study of fossil pollen (palynologists), learned from past records that species have different migratory histories (Pielou, 1991). That is, every species making up an ecological community is unique in its ability to adapt and disperse in response to changing climatic conditions. Some species spread at faster rates and at different times. Consequently, the plant and animal communities that established themselves after the last glaciation were quite different from the communities they originated from. What resulted were entirely new classes of species associations and ecosystems.

We do not have to rely on historic records for this evidence – it is happening all around us today. Researchers have documented recent widespread northward shifts in species of mammals, birds, and butterflies throughout North America and Europe (McCarty, 2001). In Great Britain, for example, 59 species of birds and 34 species of butterflies shifted their range northward within the past several decades (Parmesan et al., 1999; Thomas & Lennon, 1999). This shift in range occurred faster than the plant communities they were formerly associated with. As a result, ecosystems are changing.

Plant communities are also changing in response to increased temperature and varying precipitation patterns. In the southwestern United States, for example, arid grasslands are being replaced by desert shrubland in response to climate change (Brown, Valone, & Curtin, 1997). This change in habitat has led to the extirpation of several locally abundant species (Brown et al., 1997). Northern latitude ecosystems are also under threat. The plant and animal communities adapted to cold, dry climates are losing ground in the southern portion of their boundary to species better adapted to warmer, wetter climates (McCarty, 2001). Montane ecosystems are another high-risk ecosystem. As higher elevations warm, species from lower elevations advance upward pushing existing vegetative communities (i.e. alpine meadows, cloud forests, etc.) to the brink of extirpation (Grabherr, Gottfried, & Pauli, 1994; Still, Foster, & Schneider, 1999; U.S. National Assessment Synthesis Team, 2001).

Widespread changes in biotic communities have not been limited to terrestrial ecosystems. Ocean surface temperatures have warmed significantly off the coast of southern California over the past few decades. This has caused an 80% decrease in the amount of zooplankton which is likely responsible for species declines higher up the food chain (such as the collapse of the Sooty Shearwater population) (Roemmich & McGowan, 1995; Veit, McGowan, Ainley, Wahls, & Pyle, 1997).

Range and abundance are not the only ways species are affected by global warming. Phenology[4] is another. For example, a study of 65 species of breeding birds in the United Kingdom revealed that 78% of them were breeding, on average, nine days earlier in 1995 than in 1971 (Crick, Dudley, Glue, & Thomson, 1997). In New York, over half of the migratory birds studied (76 species) are now returning from their wintering grounds significantly earlier than they were at the beginning of the century (McCarty, 2001). Phenological changes are not limited to birds. Species of amphibians, insects (especially butterflies), trees, and spring wildflowers have all experienced significant changes in the timing of their life history traits (McCarty, 2001). Problems emerge when shifts in phenology result in a breakdown of symbiotic relationships and when basic species' requirements become mismatched with important ecological events. For example, bird species time their breeding cycle so that their chicks hatch at or around the peak abundance of insects. A variation of a few days can make a big difference. This has happened in the Netherlands with Great Tits. Their insect food source is now peaking nine days earlier and on the wane when Great Tit chicks hatch (McCarty, 2001). The result of less food is less reproductive success and a decline in the overall population. Darwinian theory suggests that individual Great Tits that breed earlier will increase their reproductive success and the species will adapt to this change in phenology. This may happen, however, climate change is happening so fast and impacting all ecological variables that it may prove to be impossible for the Great Tits to adjust their reproductive

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[4] Phenology, as used here, refers to long-term changes in the timing of species' natural history traits (i.e. the onset of courtship, nest-building, egg laying, flowering, hibernating, etc.) as a consequence of changing climatic conditions.

timing. Of course, this example of the Great Tit and its food source represents one specific (and simplified) case study. Shifts in species phenology are now pervasive and affecting the dynamic relationships between and within ecosystems in a manner that we are only beginning to understand.

Abundance, range, and phenology are just a few of the many ways species are likely to change in response to global warming. Physiology, behavior, and morphology will likely be others. The point is, change does not necessarily mean worse. So why are conservation biologists so concerned? A primary reason is the unprecedented rate and magnitude of our current warming trend. Once again, the main question is: "will ecosystems and their corresponding species be able to adapt quickly enough to keep pace with our rapidly changing climate?" For some biotic communities the answer is likely no. The U.S. National Assessment Synthesis Team (2001), predicts that some alpine meadows, mangroves, tropical mountain forests, and coral reef communities will disappear by 2100.

Another reason why conservation biologists are so concerned about the effects of climate change on biodiversity is that the landscape has been extremely modified since the end of the last glaciation. In this case, the past may not be key to the present. The present is not favorable to species dispersal and reestablishment (Schneider, 1997). Human activities have created significant barriers over the past couple hundred years. People have cleared natural areas, built freeways, constructed large cities (complete with urban sprawl), and developed huge agricultural zones, industrial parks, and military bases. Additionally, we have dug, cleared, or altered the landscape in order to extract natural resources (i.e. natural gas, oil, coal, water, forests, limestone, copper, etc.) and create massive landfills. How will these barriers affect plant and animal communities as they struggle to adapt to a vastly different climate? The outlook is worrisome since many of today's biotic communities are already fragmented, polluted, and otherwise weakened.

Conservation biologists are also concerned about the spread of invasive species. Unfortunately, aggressive and highly adaptive invasive species are poised for proliferation under our new climate regime. In other words, the natural history traits of weedy plants, agricultural pests, mosquitoes, ticks, rats and others are best prepared to deal with unstable but warmer future conditions. Their proliferation will likely come at the expense of native species.

Taken as a whole, the synergistic effects of a rapidly changing climate, with profoundly altered ecological communities, combined with the likely spread of invasive species could push many of the world's declining and most charismatic species to the edge of extinction. Already, a conservative estimate of 20,000-30,000 species become extinct every year (Meffe, Carroll, & Contributors, 1997). In the U.S., where we have already lost approximately 500 of our native species since European settlement, one has to wonder what the future has in store for our 1,264 federally protected species (USFWS, 2007). If the past is any indication, then American citizens should be deeply concerned about the potential of wide-ranging species extinction. At the end of the last glaciation, our continent experienced a mass extinction. Thirty-five to forty of our largest most charismatic species (i.e. mammoths, giant ground sloths, sabertooth tigers, camels, shruboxen, bison, giant beavers, etc.) disappeared between 12,000 and 9,000 years ago (Pielou, 1991). While some of the underlying causes remain controversial, we can be quite certain that a rapidly changing climate coupled with hunting pressure from indigenous peoples played a key role. It seems reasonable to assume that today's climate change coupled with pressures from contemporary human societies would have similar if not worse results for U.S. and globally threatened species.

It is important to remember that species are essential and defining components of healthy ecosystems. The loss of enough species can compromise the integrity of functioning ecosystems. Researchers have demonstrated that greater biodiversity leads to greater productivity and greater productivity leads to greater ecosystem stability (Tilman, 2000). How many species can we lose before entire ecosystems collapse? Paul Ehrlich's "popping-rivet" analogy helps explain the situation: "The Earth is like a plane flying in the sky and the rivets that hold the plane together are its inhabiting species. Losing one or two rivets from the plane is not critical. However, rivets are popping out of the plane at an unprecedented rate. The impending result is obvious… (Ehrlich & Ehrlich, 1981)." Ehrlich wrote than in 1981. Since then, the rate of global extinction has continued to increase, and if predictions are right, we can expect this trend to continue as another consequence of global warming.

~ Threats to Human Health ~

Needless to say, when ecological communities change, when invasive species proliferate, and when species become extinct humans are affected. The quality of human life is utterly dependant on healthy and functioning ecosystems. Ecosystems cleanse the air and water, recycle nutrients, and provide us with fertile soils (Speth, 2004). Nature provides us with food, fuel, fiber, and medicines (Tilman, 2000). And, for countless millions of people worldwide, nature provides aesthetic beauty, psycho-spiritual benefits, and recreational opportunities. Simply put, humans must protect the biodiversity and natural ecosystems that sustain our lives.

The potential loss of biodiversity and ecosystem services is not the only direct threats of a changing climate to human health. Other concerns include surging cases of heat stroke. The U.S., should especially take note: average U.S. temperatures are expected to increase 3-5 degrees C compared to 2.4 degrees C for the global average by 2100 (U.S. National Assessment Synthesis Team, 2001). There is scientific consensus that heat waves throughout this period will increase in both frequency and intensity putting segments of the human population (i.e. infants, elderly, poor, etc.) at a much greater risk of heat induced mortality. The 1995 Chicago heat wave and the 2003 heat wave that swept through Western Europe provides insight into what can be expected. In Chicago, temperatures reached 106 degrees F (41 degrees C) and resulted in the deaths of approximately 600 people (The University of Chicago, 2002). In Western Europe, over 30,000 people died in their heat wave (McMichael, Woodruff, & Hales, 2006). France was hit especially hard: temperatures exceeded 104 degrees F (40 degrees C) resulting in the death of an estimated 14,000 people (Diaz, 2006). Closer to home, the summer of 2006 saw record-breaking heat throughout Washington State. East of the Cascades, for example, temperatures exceeded 107 degrees F in places. Air-conditioning is the often the best option to prevent heat stroke. Unfortunately, air-conditioning is also energy intensive increasing the amount of CO_2 emissions and further exacerbating global warming.

Global warming is also likely to spread certain human diseases. The spread of seasonal asthma and other respiratory diseases is now under investigation. In the U.S., for example, rates of acute asthma increased from 19 to 35 per 10,000 children from 1979 to 2001 (Diaz, 2006). This trend is expected to increase as warmer, drier summers cause more forest fires resulting in greater levels of air pollutants. Malaria is also spreading to new altitudes and latitudes where it was absent just a few years ago (Diaz, 2006). The combination of global warming and increased precipitation is believed to be the cause. This is of great concern because malaria is already the number one insect-born killer of people worldwide. Besides malaria, shorter, milder winters will likely result in the spread of other insect-born infectious diseases such as West Nile Virus, St. Louis encephalitis, and Lyme disease in North America; dengue and yellow fever in Latin America; dengue and Japanese encephalitis throughout Asia; and Ross River fever in

Australia, just to name a few (Diaz, 2006). And, bacterial infections, such as salmonella and cholera, also proliferate under warmer conditions and are expected to thrive under future scenarios (McMichael et al., 2006).

II. Impacts of Climate Change in the Northwest (especially Washington State)

"Climate change poses a profound threat to Washington's and the world's environment. The potential adverse impacts are of a scale and magnitude that are beyond daunting"

Jay Manning, Director, WA Dept. of Ecology

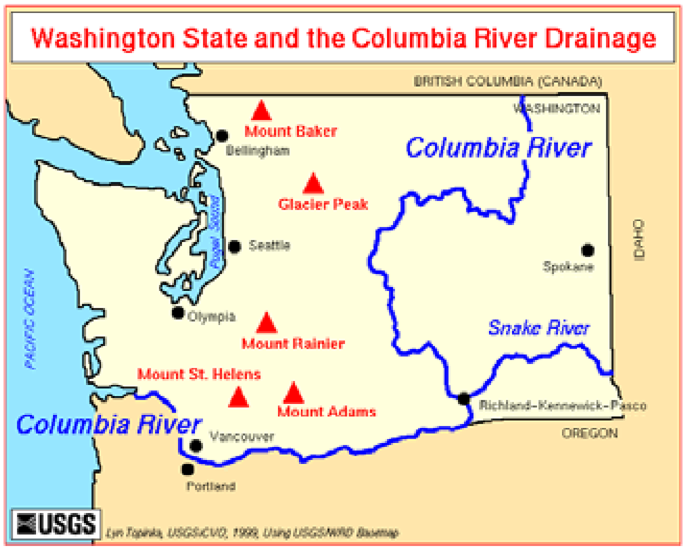
Despite the fact that climate change is a global issue, the local impacts will be vastly different. To develop a better sense of how global warming will affect you, it is important to consider how global warming will affect the people, place, and region where you live. This section will focus on climate change impacts specific to the Northwest (Washington State, Oregon, & Idaho) with particular attention on Washington State and the Puget Sound region.

To start, it is important to realize that no matter which region you live in, global warming will likely exacerbate many of the natural resource and sustainability issues that already exist. The Northwest is no exception. Our region is already faced with significant sustainability challenges and threats to our biodiversity. For example, only 10-20% of our regions old-growth forests remain, freshwater availability and quality are a constant source of tension including periodic severe shortages (i.e. 1987, 1992, and 1999), many wild salmon stocks are endangered with nearly half of the 58 wild stocks currently protected under the Endangered Species Act, and our orca population is considered the most contaminated marine mammal population on Earth and in 2005 was placed on the Endangered Species List (Sightline Institute, 2006; U.S. National Assessment Synthesis Team, 2001). This list, of course, is far from comprehensive. The question to consider is, "how will global warming impact these and other natural resource and sustainability challenges our region already faces?" It is time to consider the impacts of climate change to Washington State and our region.

~ Water Shortages ~

There is no better place to start than with freshwater issues. To be sure, of all the global warming impacts the Northwest is likely to experience, none will be more problematic than water shortages. This may come as a surprise to some since the Northwest is widely recognized as being wet and rainy. However, this is over exaggerated. Most of the precipitation our region receives occurs on the west side of the Cascades and even this area is fairly dry during the summer months. The truth is that the Northwest averages only about 20 inches of annual rainfall and water shortages are already a problem throughout the region (U.S. National Assessment Synthesis Team, 2001).

Figure 5. *The Columbia River Drainage Basin in Washington State.*



Problems along the Columbia River. No single source of freshwater better exemplifies the water problems of the Northwest than the Columbia River drainage basin. The Columbia River is the second largest river in the United States. It stretches for over 1200 miles as it cuts through Washington State and delineates the border between Washington State and Oregon (Figure 5). Without a doubt, it is the most heavily relied upon river in the region and its health and status are critical to the economy and quality of life for the millions of people who depend on it. This river sustains Native cultures and their traditions, supplies irrigation water for agricultural purposes, provides fishing opportunities, generates hydroelectric power, serves as habitat for endangered species, and allows for numerous recreational opportunities. Unfortunately, there is not enough water to support these multifarious needs and water shortages are a reoccurring problem.

Furthermore, this problem is going to get worse because the Northwest is experiencing a population boom. Since 1970, the regions population has nearly doubled with a growth rate almost twice that of the national average (U.S. National Assessment

Synthesis Team, 2001). In Washington State, population growth outpaced the national average 6.7% to 5.3%, respectively, from 2000-2005 (U.S. Census Bureau, 2007). For both the region and the state, this trend is expected to continue. Needless to say, more people will be demanding diminishing supplies of freshwater from the Columbia River basin further straining ecosystems, wildlife populations, agricultural productivity, and the economic and industrial sectors. And there is not much more that can be done. The Columbia River is already one of the most highly developed river systems in the world – it has been repeatedly dammed, drained, and altered. Yet, no one has figured out how to create more water. The result is an intense political battle (centered on value-sets) as to how available water should be allocated.

Battle-lines and value-sets are especially poignant and uncompromising in water issues. Water is highly valued for its aesthetic and recreational attributes (such as rafting, kayaking, fishing). It is valued as essential habitat for endangered species (i.e. such as salmon and/or riparian species such as migratory birds). Today, there is increasing recognition of the intrinsic value of in-stream flow. In other words, more people are demanding that more water be left in the river to support these recreational values and healthy ecosystems. At the same time, water is valued for economic growth and industrial purposes. And, most importantly, water is highly valued as a basic necessity to support human life (such as clean drinking water and crop irrigation). Supporting these values requires that water be pumped out of the river system. The point is, different values create different demands and as long as there is a water shortage there will continue to be troublesome value disagreements. Unfortunately, overcoming value disagreements require a cumbersome and long-term effort.

The Problem in Yakima Valley. The water situation in Eastern Washington is especially problematic. The Yakima Valley, which is the agricultural hub of Washington State, receives only seven inches of rain per year; making it one of the most arid places in the United States (U.S. National Assessment Synthesis Team, 2001). To be sure, the agricultural industry in the Yakima Valley is vital to the economy of Washington State. It is a $2.5 billion industry (U.S. National Assessment Synthesis Team, 2001). Unfortunately, it can only be supported through irrigation. Much of the water provided for summer irrigation is supplied by melting glaciers and winter snowpack. The rest comes from the pumping of groundwater from aquifers (particularly the Odessa Aquifer). The problem is that the farmers in this region are pumping the groundwater faster than it can be replenished. Inevitably, wells run dry and crops fail.

How did Yakima Valley farmers get in this situation? When agricultural interests first settled in Eastern Washington they were granted water rights on the supposition that dam storage would provide future water for their use. Until then, they were free to siphon water from the Odessa aquifer. The dams were never built and more farmers (along with industry and municipalities) kept requesting and receiving additional water rights. As a result, the Odessa aquifer is being sucked dry at the same time demand for its water has been steadily increasing. This situation has forced the Department of Ecology to place a moratorium on permitting new water rights. Therefore, the problem in Eastern Washington with the Columbia River watershed can be boiled down to one straightforward reality that captures the larger problem throughout the region: water has been over-allocated and today there is simply not enough water to satisfy everyone's needs.

Impacts of Global Warming on Existing Water Supplies. So, how will global warming impact the existing water problem of the Northwest (particularly Washington State)? The short answer: water problems will be amplified. The severity of future water problems will be directly correlated to increases in temperature (especially during the summer months). As we know, the rate of warming is expected to increase, therefore, so are water problems. More specifically, Northwest temperatures increased between 1-3 degrees F (0.6-1.7 degrees C) during the 20th century and are expected to increase another 2 degrees F before 2030 (U.S. National Assessment Synthesis Team, 2001; Climate Leadership Initiative, 2006). The reason being that warmer temperatures in the Northwest translate into warmer, wetter winters and longer, drier summers. As a result, mountain snowpack will decline because warmer winters mean less precipitation falling as snow and longer summers mean existing snow will melt at a greater rate than it can be replenished. Already, the snowpack in the North Cascades is disappearing: average snowpack has declined at nearly ¾ of the mountains studied thus far (Climate Leadership Initiative, 2006). Of course, warmer temperatures are also melting the region's glaciers. Glaciers in the North Cascades have lost nearly 1/3 of their volume since 1983 and by some estimates up to ¾ of them may disappear by 2100 (Climate Leadership Initiative, 2006).

For a region already stressed by water issues, warmer average temperatures are an unwanted reality. Warmer temperatures cause an earlier spring runoff (snowmelt). In Puget Sound, for example, spring snowmelt is now occurring 12 days earlier than it did just a few decades ago (Snover et al., 2005). And disappearing glaciers coupled with a diminishing snowpack means that less water is available to feed the region's rivers during the summer months. The combination of these factors means that these precious sources of freshwater are insufficient when they are needed most – in mid to late summer. The result is drought. Over the past 30 years, droughts have increased in both frequency and intensity. Streams have dried, crops have failed, fish have been killed, and revenue from hydroelectric power has been reduced (Climate Leadership Initiative, 2006). In the last few years, the Northwest has already experienced two severe droughts forcing gubernatorial intervention by declaring drought emergencies (Climate Leadership Initiative, 2006). In particular, the winter drought of 2004-05 was the worst in recent memory. By March the snowpack was only 26% of what it normally is (U.S. National Assessment Synthesis Team, 2001).

Pacific Salmon. Freshwater, as an available resource is not just threatening to humans, salmon populations are also at risk. All species of Pacific salmon (*Oncorhynchus spp.*) depend on freshwater for breeding purposes and to complete their lifecycle. When the Northwest Pacific salmon return to their natal grounds (between late summer and the end of fall) they depend on clean, cold, and oxygen rich water. Unfortunately, global warming is creating a situation where the flows are lower, the water is warmer, and the amount of dissolved oxygen is insufficient. And this all happens during the most stressful time in the lifecycle of the salmon – as they migrate upstream to their spawning grounds. It is exactly this combination of factors that weakens spawning salmon and causes the spread of pathogens. The result can be massive die-offs. For example, low flows and high temperatures appeared to be the ultimate cause of the massive Klamath River, California die-off of 2002 (where 20,000-30,000 fish died in the lower reaches of the river) (Quinn, 2005). And, on the Fraser River in 2004, there was a major die-off of sockeye salmon. Apparently the result of warm water temperatures (Climate Leadership Initiative, 2006).

The challenge for salmon populations does not end with the arrival to their spawning grounds. Low river flows can be problematic at anytime of the year for salmon. The drought of 2001 is a case in point. Juvenile salmon undertaking their annual migration from their natal grounds in the Columbia River to the ocean encountered extremely low-flowing sections of the riverbed and became stranded. Hundreds of thousands of salmon perished (Climate Leadership Initiative, 2006).

Another major problem salmon are encountering in the face of climate change is a disruption in the timing of their natural history events. Events, such as date of spawning, length of incubation, time spent in freshwater, when to commence their migration to the sea, etc., are all carefully coordinated (through natural selection) to maximize the populations likelihood of survival. The timing of these events is not only specific to each population but are perhaps the most important set of factors influencing each populations long-term survival. Global warming is changing the environmental in such a manner that the timing of these events is being critically altered. For example, each population of salmon has a range of dates in which to spawn that will maximize its chances of survival. Water temperature is an important environmental factor because it determines the rate of embryonic development (Quinn, 2005). More specifically, the warmer the temperature the faster the embryo's metabolism and development is. Because of this relationship, adult salmon have "selected" a spawning date that optimizes their offspring's chance of survival. However, warmer temperatures may result in faster embryonic development throwing their reproductive cycle out of whack. If this was the only factor influencing the timing of important natural history events then we could be more confident salmon would adapt. However, levels of dissolved oxygen, nutrient availability, spring runoff, predator abundance, inter and intra specific competition, and ocean temperature are just of few of the many factors that influence important timing events in each population's lifecycle. Throw in already existing stressors such as habitat degradation and pollution, hatchery fish, commercial fishing pressures, disease, dams, and predators and it may be more than wild salmon populations can handle. Already, Northwest salmon have disappeared from nearly 40% of their former range and many of the remaining populations are in decline or at risk of extinction (Climate Leadership Initiative, 2006). Despite their protection under the Endangered Species Act and the fact that millions of dollars are spent annually on salmon research and recovery, climate change is likely to hinder or completely overwhelm conservation efforts. In Washington State, for example, it is estimated that only 38% of the salmon populations are healthy (Quinn, 2005). The others are either in jeopardy (22%), already extinct (16%), or information is insufficient to know (24%) (Quinn, 2005). As global warming continues to intensify it will compound already existing pressures on salmon evolutionary capabilities. To say the least, this ought to make one feel uncomfortable about the fate of this all-important Northwest species.

Hydroelectricity. Global warming will also affect energy production throughout the Northwest. This region is highly dependent on hydropower. In Washington State, for example, dams generate 72% of the state's electricity (Climate Leadership Initiative, 2006). As mentioned above, global warming is causing earlier peak flows in the spring and reduced in-stream flows in the summer. Consequently, hydroelectric energy production is reduced at the very time when it is needed most – during the hot, dry summer months – to run air conditioners. Because the summertime supply will be reduced and the demand will be greater, residents can expect to pay higher rates for electricity and the hydroelectric industry can expect to lose substantial amounts of money because the dams will be unable to reach their potential production.

Groundwater. The regions other main source of freshwater – groundwater – is also at risk from climate change. Glacial runoff and snowmelt are both important factors for recharging aquifers. Also, longer, warmer summers will increase the amount of evaporation that will contribute to drier soils. Inevitably, wells are going to run dry. None of this translates very well for the agricultural community or aspiring water-rights holders.

In sum, climate change is exacerbating water shortage issues throughout the Northwest. For sure, water allocation will be a continuing challenge for Northwest decision makers in the years ahead.

~ *Rising Sea-Level* ~

Unfortunately, water availability is not the only threat to the Northwest from global warming. Rising sea-level is also a major concern. In Washington State, for example, a large portion of the population lives, works, and recreates near the states 2,300 miles of coastline (Climate Leadership Initiative, 2006). In some areas of the Northwest the problem is compounded by the fact that the land is also subsiding. South Puget Sound (between Tacoma and Olympia), for example, is subsiding more than 8 inches per century (or 2mm/yr) (Snover et al., 2005). The combination of sea-level rise with subsidence means that 1 to 5 inches of land per decade will be inundated by intruding salt water (Climate Leadership Initiative, 2006). A two-foot rise in sea-level, for example, would inundated approximately 56 square miles of land and displace over 44,000 Washingtonians (Climate Leadership Initiative, 2006).

Coastal Erosion and Infrastructure Damage. At the same time seawater is creeping closer to coastal communities, climate change is expected to produce more frequent heavy precipitation events and more powerful storms. This will not only increase the potential for landslides and erosion, but coastal infrastructure will be at an additional risk from storm surges and more intense wave action (Climate Leadership

Initiative, 2006). For example, above average winter rainfall contributed to the destructive 1999 landslide in the Carlyon Beach area of Thurston County. This landslide damaged 41 homes and millions of dollars worth the damage (Climate Leadership Initiative, 2006). Already, storm waves off the coast of Oregon and Washington have been measured eight feet higher today than only 25 years ago (Climate Leadership Initiative, 2006). By all accounts, the rate of property and road damage is expected to increase as a result of flooding and greater wave action.

Salinization of Aquifers. Rising sea-level is also a threat to coastal and low-lying freshwater aquifers. The fear is saltwater intrusion. As mentioned above, aquifers are already at risk from over-pumping and reduced recharge. The last thing coastal communities need is for their groundwater to become contaminated by saltwater. Unfortunately, this is likely to become reality as sea-level continues to rise.

Salt Marshes. Another impact of rising sea-level will be the likely loss of coastal salt marshes. From an ecological standpoint, these areas are incredibly important. They serve as nurseries for all kinds of aquatic organisms, are feeding grounds for shorebirds and wading birds, they purify the water, regulate levels of dissolved oxygen, and serve as buffer zones between the sea and shore (Snover et al., 2005). Regrettably, somewhere close to ¾ of the salt marshes that once existed in Puget Sound are now gone due to human activities. The character of the remaining salt marshes are highly affected by sea-level, salinity, temperature, and varying levels of freshwater inputs (Snover et al., 2005). Global warming will influence all of these factors. Whether or not salt marshes can overcome these near-term changes is a matter of speculation. What is certain is how important they are to the communities and biodiversity in the coastal Northwest.

~ Forest Ecosystems ~

The forest ecosystem is incredibly important to the people of the Northwest. The typical Northwest resident is hard-pressed to travel very far without encountering a stand of trees. Over half of Washington State (22 million acres out of 43 million acres) is forestland (Climate Leadership Initiative, 2006). These forests are essential for their ecosystem services, biodiversity, aesthetic value, and for the recreational opportunities they provide. In particular, half of the world's temperate rainforests are found in this region and are considered to be among the most biologically productive and beautiful places on the planet (U.S. National Assessment Synthesis Team, 2001). For many people these massive, dense, dark, and moist forests are some of the most awe-inspiring places on Earth. Taken together, the Northwest forest defines the character of its people. Washington's motto as "The Evergreen State" is only one indicator of this.

However, even these highly revered forests are not immune from the threats of modern day society. As mentioned above, approximately 80% of the old-growth forests have been harvested and no longer remain. By one account, this activity has resulted in the release of over 2 billion metric tons of carbon into the atmosphere (U.S. National Assessment Synthesis Team, 2001). Particular species, like the ponderosa pine (which formerly covered ¾ of the eastside of the Cascades), have been so selectively targeted that less than 10% of their stands remain (U.S. National Assessment Synthesis Team, 2001). Furthermore, a growing population coupled with urban sprawl, air pollution, clearing forests for agriculture, and invasive species will continue to threaten the composition and character of Northwest forests.

Forest Fires. Like all aspects of the biosphere, global warming is also impacting Northwest forests. Longer, drier summers are increasing the frequency, size, longevity, and intensity of large forest fires. The number of annual large forest fires (greater than 500 acres in area) are more than three times more frequent today than they were in the 1970's (Climate Leadership Initiative, 2006). Additionally, the number of acres projected to burn annually, will double by 2040 (Climate Leadership Initiative, 2006). This will not only cause air quality problems but will also threaten communities and precious forest resources when these fires burn out of control. Fires are also an effective means to rapidly release decades of stored carbon into the atmosphere in a very short period of time. Obviously, this positive feedback mechanism will further contribute to global warming.

Insect Outbreaks. Under the influence of a new climate regime, Northwest forests are ripe for massive insect infestations. Bark beetles, for example, have a lower rate of mortality during shorter, milder winters. These circumstances not only extend their breeding season, but more survive to reproduce. Additionally, much of the logged old-growth forests throughout the Northwest, have been replanted with dense, even aged stands of the same type of trees. Under these conditions the spread of bark beetles can be rampant. Huge tracts of standing dead trees, all in close proximity, only facilitate the likelihood of forest fires. This exact situation is currently happening in the Tongass National Forest in Alaska. Millions of acres of forest have been killed by bark beetles and every summer there are massive forest fires. Closer to home, in British Columbia, Canada, more than 21 million acres of forest have already been killed by the beetle and that number is likely to triple in the next few years (Climate Leadership Initiative, 2006).

As mentioned earlier, drought conditions are likely to increase under the new climate regime. Because droughts stress trees they make them less resistant to insect pests. Studies have shown a direct correlation between outbreaks of bark beetles, spruce budworms, and other defoliating insects with drought conditions (Swetnam & Lynch, 1993).

Forest Productivity. Not all of these impacts are potentially bad. Trees, of course, breathe in CO_2 and convert it to food (carbohydrates) through photosynthesis. Therefore, increasing the amount of atmospheric CO_2 may increase the growth rate and productivity of managed forests (U.S. National Assessment Synthesis Team, 2001). However, trees also need water in combination with CO_2 in order to grow. As it turns out, water (in the form of soil moisture) may be in short supply especially in the arid eastern part of the region. In sum, the combination of drought, reduced soil moisture, insect pest outbreaks, and more frequent and intense large forest fires will likely offset any long-term benefit increasing levels of CO_2 may have on Northwest forest ecosystems (U.S. National Assessment Synthesis Team, 2001).

~ *Economic Consequences* ~

Obviously, the costs of global warming are not only measured in frequency of forest fires, inches of sea-level rise, occurrence of water shortages, or any of the other impacts associated with global warming, they are also starting to be measured in economic terms. In fact, the Climate Leadership Institute out of the University of Oregon just completed the first ever state-level assessment of the economic costs of climate change to the state of Washington[5]. To be sure, there are significant information gaps in that report. Imagine the daunting task of determining (with a reasonable degree of certainty) the total cost of all possible economic impacts associated with global warming. There are many assumptions and uncertainties. As a result, no final all encompassing lump sum can be given at this time. Furthermore, the researchers took a conservative approach so what figures are available are likely underestimated. Nevertheless, this is a highly valuable

[5] In this section, I relied heavily on the results of the Climate Leadership Initiative Report. The full report, and all of its details, can be accessed through the Washington State Department of Ecology website: http://www.ecy.wa.gov/climatechange/

assessment and a great place to begin our look into the fiscal costs of global warming to Washington State.

Water Shortages Associated with Longer, Drier Summers. The most easily quantifiable costs associated with global warming come from straightforward projections stemming from water shortages. For example, we know that global warming will likely result in longer, drier summers throughout most of Washington State. As a result, Seattle, Spokane, and Yakima-area communities are all likely to face water conservation costs of $8 million annually by 2020, while at the same time the state government will spend an additional $680,000 per million gallons per day in conservation efforts (Climate Leadership Initiative, 2006).

Another major concern with longer, drier summers is a lack of irrigation water needed to support Washington's multi-billion dollar agricultural industry. Eastern Washington, for example, provides our nation with 60% of its apples and a significant portion of other crops (i.e. wheat) and fruit (U.S. National Assessment Synthesis Team, 2001). The Climate Leadership Institute estimates that summer droughts could cost Yakima Valley alone $79 million per year by mid-century (Climate Leadership Initiative, 2006).

As mentioned earlier, global warming will also be a financial burden to the hydroelectric industry. This could present a significant economic impact for Washington State and its citizens because hydropower is produced relatively cheap and it comprises the overwhelming majority (72%) of all electricity produced in the state (Climate Leadership Initiative, 2006). Right now, Washington State residents pay some of the lowest energy rates in the nation (i.e. 9^{th} lowest in 2003) (Climate Leadership Initiative, 2006). Global warming is likely to change this desirable condition, because the supply of hydroelectricity will, at best, remain the same while summertime demand increases. Unfortunately, lower summer in-stream flows are less able to generate electricity at the time when more electricity is needed to run energy intensive air-conditioners and irrigation pumps. Furthermore, Washington's rapid population growth will add further demand to limited supplies. Inevitably, this increase in demand will increase the cost of electricity.

Fortunately, milder winters will reduce the energy needed to heat homes. Consequently, demand and cost will likely be lower during the winter season. However, these savings will be more than offset by a protracted and more intense summer season. Researchers at the University of Washington concluded, under a wide variety of scenarios, that up to $165 million could be lost annually in Washington's hydroelectric industry (Climate Leadership Initiative, 2006). Complicating the situation will be the unknown affects of warmer temperatures on juvenile salmon. If water temperature increases too much, it could result in massive die-offs of salmon. Dam managers will be forced to consider the release of precious water through dam spillways in order to save federally protected salmon populations (Climate Leadership Initiative, 2006).

Forest Resources. I mentioned above some of the ways Washington's forests will be affected by climate change. Obviously, economic impacts will be profound as these vast forests are a vital component to the regions economy. Over 43,000 Washingtonians have jobs associated with the timber industry (Climate Leadership Initiative, 2006). Coniferous trees, for example, are especially abundant and they provide our country with about 3.6 billion board feet annually or about ¼ of its softwood lumber and plywood (U.S. National Assessment Synthesis Team, 2001; Climate Leadership Initiative, 2006). Forest fires may prove to be the largest drain to Washington State's timber industry. Global warming is expected to be the cause of a doubling of the number of acres burned annually by 2040 (Climate Leadership Initiative, 2006). The Climate Leadership Initiative figures that the cost of fire prevention and response to Washington State could double from $26 million today to $52 million by 2040 and the direct costs of fighting wildfires could increase 50% by 2020 (exceeding $75 million annually) (Climate Leadership Initiative, 2006)[6]. These costs do not account for a loss in timber sales, health impacts due to air pollution, tourist revenue lost from park closures, or other costs associated with forest fires. The total cost of increased forest fires to Washington State could be 4-5 times the estimates stated by the Climate Leadership Initiative (2006).

Besides the obvious loss of product from forest fires, timber yield is likely to also decrease due to reduced soil moisture, spread of disease, and insect infestations associated with warmer summer temperatures. Though there are no current quantitative estimates as to how much this might cost, one study out of California predicted an 18% reduction in yield (Battles et al., 2006). Surveys have revealed that forest managers are not overly concern about how climate change will impact their productivity because they feel that increased CO_2 and warmer temperatures will actually increase yield in the short-term (U.S. National Assessment Synthesis Team, 2001). However, as this study indicates, forecasts for long-term yields are much less promising.

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[6] This does not include federal expenditures in Washington State that are also expected to double from $24 million to $48 million by 2040.

Public Health Costs. Washington State health costs are likely to increase as a result of global warming. We have already seen that the frequency and intensity of forest fires will increase and this will significantly reduce air quality. According to the Washington Department of Health, costs associated with asthma, for example, currently cost the state about $400 million per year (Washington Department of Health, 2007). Unfortunately, Washington State has one of the highest rates of asthma in the country and it is increasing faster than the national average (Center for Disease Control and Prevention, 2007).

In September 2006, Washington State saw its first case of West Nile Virus (Center for Disease Control and Prevention, 2007). Future climate scenarios (droughts punctuated by short periods of intense rain), favors the spread of West Nile Virus. By considering what West Nile Virus has cost other states, health officials can project what it might cost Washington State. That projection is between $20 and $25 million per year (Center for Disease Control and Prevention, 2007). This does not include the "value of a statistical life" estimate. If the number of deaths is estimated and a "statistical life" is factored in then the annual costs exceed $670 million (Climate Leadership Initiative, 2006).

Sea-Level Rise and Flooding Damage. Washington State's vulnerability to sea-level rise may turnout to be the most costly effect of global warming. There are no comprehensive estimates as to how much this may cost, but undoubtedly, if sea-level rise projections occur, the price tag will be in the billions of dollars. Specific projects help to shed light on the enormous potential costs. Seattle's Alaskan Way seawall, for example, if it is re-designed to factor in a 2-foot rise in sea-level, would cost an additional $25-$50 million (Climate Leadership Initiative, 2006).

The Climate Leadership Initiative is clear to express how a final, lump sum, cost of global warming to Washington State cannot be estimated. The dynamic relationships between different economic sectors and on the economy as a whole are too complex for comprehensive projections. Additionally, the fiscal impacts of global warming on Washington State tourism, recreation, agriculture, commercial fishing (declining salmon stocks especially), wine production, and dairy revenues are just a few of the many economic sectors where uncertainties are so prevalent that even rough estimates are difficult to make. One of the challenges, of course, is the fact that Washington's economy is very much influenced by the economic conditions outside of state and national borders. For example, how will the specific impacts of global warming to Alaska, California, or Japan influence Washington's economy? A difficult analysis, to say the least. For these reasons, economists are only beginning to examine the potential costs of global warming and the estimates that are available are crude. Despite this, one relationship is seemingly obvious: *the economic costs of climate change in Washington State (and elsewhere) will grow as temperatures increase* (Climate Leadership Initiative, 2006).

III. Chapter Summary

It is critical for policymakers and citizens in general to understand the ongoing and potential impacts of global warming. Only then can informed decisions be made on how and when to address global warming. In this chapter, we have seen that climate change is a global problem for two specific reasons. First, the greenhouse gas emissions of one nation or region will impact the climate of other nations and regions. Second, no nation will be impervious to steadily increasing global temperatures and the impacts associated with them. This is especially true in today's highly globalized world where cultures and economies are dependent on events happening elsewhere. With this being said, specific local and regional impacts of global warming will be quite different and it is important for individuals to understand these impacts. "How will global warming affect the people and the place where you live?" is a question everyone should ask.

Until recently researchers have focused primarily on the geophysical impacts of climate change. However, serious attention is now being given to its economic costs. These impacts will be substantial and are a critical component in helping us to understand the full spectrum of climate change impacts.

Finally, a key theme underlying this chapter is that global warming will further exacerbate many of the social and environmental problems we already face as a modern-day civilization. Taken as a whole, global warming is a pervasive and significant threat to needs to be addressed.

CHAPTER 3

A Time for Action:

The Imperative Need to Reduce Greenhouse Gas Emissions

"We have to stabilize emissions of carbon dioxide within a decade, or temperatures will warm by more than one degree. That will be warmer than it has been for half a million years, and many things could become unstoppable. It's hard to say what the world will be like if this happens. It would be another planet."

James Hansen, Director of the NASA Goddard Institute for Space Studies, 2006

I. A History of Business-As-Usual

The issue of anthropogenic global warming is not new. Scientists have been studying the issue for over 100 years. For example, as far back as 1904, Swedish scientist Svante Arrhenius was researching what possible effect the doubling of CO_2 would have on our planet's climate regime (PBS, 2005). And, in the 1950s, Roger Revelle and Hans Suess demonstrated that the widespread burning of fossil fuels were causing global atmospheric CO_2 levels to rise (PBS, 2005). Global warming, as a political issue, is not new either. In the 1980s, representative Al Gore (D-TN), co-sponsored the first congressional hearings on the subject; and in 1988, NASA climate scientist James Hansen, submitted a report to Congress with a warning that global warming will have major social and environmental impacts (PBS, 2005). Also in 1988, the international community began to organize on the issue. The United Nations Environment Programme and the World Meteorological Organization established the Intergovernmental Panel on Climate Change. Its purpose was to thoroughly investigate global warming from a scientific, socio-economic, and policy perspective. The Intergovernmental Panel on Climate Change has since published four comprehensive reports with contributions from over 1,000 of the world's leading climate scientists. The four reports evolved from a suggestion of human induced global warming (First Assessment Report, 1990) to a greater than 90% probability that human activities are contributing to the unequivocal warming our planet is experiencing today (Fourth Assessment Report, 2007). Personally, I remember lengthy and unsettling discussions on global warming in my high school Earth Science class in 1989.

Yet, through it all, most of the industrialized world has done very little (if anything) to address the problem. The U.S., in particular, is the world's leading laggard. America emits an overwhelming majority (22%) of the world's anthropogenic greenhouse gases and instead of making an effort to lower or even stabilize emissions they continue to rise (Porter et al., 2000). The EPA recently reported that from 1990 to 2004, total U.S. greenhouse gas emissions rose 15.8% with an increase of 1.7% from 2003 to 2004 (the latest year the EPA had complete data for) (EPA, 2006b). Moreover, a 2007 White House report to the United Nations projected that the U.S. would increase their 2000 level emissions 20% by 2020 (McKibben, 2007).

One has to wonder why. Why – after 100 years of scientific investigation, decades of congressional hearings, nearly 20 years of international scientific collaboration, and in light of all the potential consequences that global warming imposes – has the global community utterly failed to take decisive action? There are three overarching reasons:

1. **Scientific Uncertainty.** A lack of consensus among the scientific community is a primary reason why modern civilization has failed to properly address global warming. Despite many decades of scientific inquiry, the science has been somewhat inconclusive. How could anyone expect otherwise? The climate system routinely fluctuates and is very complex. As a result, the debate as to whether global warming was occurring and whether human activities were responsible for it persisted. In fact, as late as the 1960s, the majority of scientists thought it impossible that humans could actually affect our planet's climate (PBS, 2005). To be sure, understanding global climate patterns as it relates to the human effect is a daunting challenge and scientific debate and uncertainty should be expected.

    In the U.S., another disturbing trend has recently emerged. The integrity of science has been under attack. Junk science, partisan funding and research, filtering of objective science that is in disagreement with political motives, and crafty editing and neutralization of scientific reports have cast a large shadow of doubt over the level of confidence and trust the American people once placed in the scientific community. This neutering of science has reached unprecedented heights over the past few years and creates a genuine concern for citizens trying to understand what is going on with our climate and what we need to do about it. Nevertheless, the 2007 Intergovernmental Panel on Climate Change Fourth Assessment Report virtually closed the door on the issues of scientific uncertainty and integrity. The report concluded that it is an unequivocal fact that the planet is warming with a greater than 90% probability that human activities are contributing to it (see Chapter 1). Furthermore, because the report had input from over 113 nations and over 1,000 of the world's leading scientists, eases concern over whether the report was done with integrity. As a result, scientific uncertainty over whether warming is happening and whether humans are contributing to it can no longer be considered acceptable reasons for inaction.

2. **Perception that Global Warming is Benign.** For years, there was a pervasive view among the general public that global warming was not a significant threat. After all, CO_2 (the villain greenhouse gas) is not exactly a frightening pollutant. It does not excite people into action the way other pollutants might. On the contrary, CO_2 is a basic and necessary component of our atmosphere. It makes life as we know it possible. Recognizing this, Svante Arrhenius in 1904, was the first of many scientists to suggest that warming would make the climate more favorable to humans and that an increase in atmospheric CO_2 would favor plant growth and world food production (PBS, 2005). For decades, the fossil fuel industry also promoted the vision of a greener more comfortable planet that would accompany increased CO_2 emissions. Undoubtedly, the thought of longer, greener summers, and shorter, warmer winters sounds quite welcoming to millions of residents living in northern latitudes in January. This view quells the social will to take compromising action against global warming.

    Furthermore, even citizens who are concerned about global warming may not place it high on their list of things to act upon. To them, there may be more pressing social issues to be concerned about. War, disease, substantial poverty, social and environmental injustice, population growth, sustainable use of natural resources, etc. are all important issues of our time. In the United States, major political concerns currently include, threats of terrorism, the war in Iraq, immigration reform, economic growth and prosperity, health care, and social security. How important is the threat of global warming when compared to these other societal challenges? In short, very important. Working Group II of the Intergovernmental Panel on Climate Change (2007a) reported that climate could threaten the lives of hundreds of millions of people in this century. And, as we saw in Chapter 2, the consequences of global warming will exacerbate many other social and environmental issues that we already deem to be important.

    The point is, the looming consequences of global warming are a major cause for concern. Visions of a global warming utopia have been replaced by images of more intense hurricanes, flooding coastlines, calving glaciers, and apocalyptic views such as those depicted in the movie "The Day After Tomorrow." A Doomsday scenario aside, the fact is, our modern-day civilization (since the Industrial Revolution) has been built under a relatively stable and predictable climate. That climate helped establish the "ground rules" for development, for industry, and for establishing cultural identity. Climate helps determine where we live, how we build, how and where we grow our food, etc. A rapid modification of the "rules" changes the game and sets the stage for harsh consequences.

In the previous chapter, I predominately focused on the negative impacts of global warming. To be sure, global warming will also have a suite of benefits. For example, milder winter temperatures will result in fewer deaths per year associated with exposure, longer agricultural growing seasons are expected in northern latitudes, and perhaps some land managers will benefit from increased forest productivity (over the short-term) (IPCC, 2007a). In the United States, overall agricultural output is not expected to be significantly impacted by global warming (U.S. National Assessment Synthesis Team, 2001). And, some nationally important crops, like Washington State's $524 million wheat yield, may actually increase under a new climate regime (Thomson et al., 2002; Climate Leadership Initiative, 2006).

However, no reputable scientist, policymaker, or informed citizen can cogently argue that global warming will have a net benefit for humanity. In fact, the potential negative consequences are so likely and so severe that no one has attempted to make this argument. Global warming as a benign situation can no longer be used to rationalize inaction.

3. **Fighting Global Warming is Economically Irrational.** The combustion of fossil fuels is the number one source of greenhouse gas emissions. Globally, over 25,500 Tg[7] of CO_2 are added to the atmosphere every year from the burning of fossil fuels (EPA, 2006b). And, in the United States, meeting our energy needs contributes over 86% of our GHG emissions (EPA, 2006b). Any serious attempt to reduce emissions would require a complete overhaul of our industrial and economic systems because our entire infrastructure is designed for the extraction, transportation, and combustion of fossil fuels to provide our energy and

[7] Tg = teragram. One teragram = 1,000,000,000,000 grams or 1,000,000,000 kilograms

transportation needs. Certainly, a radical shift away from fossil fuels would come with its own set of risks. Economic prosperity, human health and well-being, and individual standard of living could all be compromised. Today's loudest voices against aggressive action to reduce greenhouse gas emissions are coming out of the economic community. Their argument is clear. Many economists claim that it is economically dangerous to substantially reduce greenhouse gas emissions and the consequences of global warming are just not worth the risk. Jonah Goldberg, contributing editor for the National Review Online, captured their sentiment when he wrote in a February 2007 article that global GDP rose about 1,800% in the 20th century. The cost? …about 0.7 degrees C of warming. The benefits? …longer lifespan, better healthcare, less poverty, and an overall better quality of life. Given the option of another 1,800% increase in global GDP during the 21st century for another 0.7 degrees C of warming, Mr. Goldberg wrote that he would "take the heat in a heartbeat (Goldberg, 2007)."

The fear of economic slowdown or even collapse cannot be taken lightly. In fact, it is a major reason why the international communities greatest attempt to combat global warming – the Kyoto Protocol – ultimately failed. The U.S., for example, would have been required to reduce greenhouse gas emissions 7% below 1990 levels. When our elected officials realized this would cost approximately $1,000 per household per year and result in the premature disposal of expensive "capital stock" they decided against ratification (Victor, 2001). To be sure, the fact that developing nations such as China and India were not held accountable under Kyoto is also an important reason for the protocol's demise. However, that reason is also economic. Developing nations would have an economic advantage because it is cheaper to continue with a business-as-usual scenario while the U.S. and other industrialized nations would be forced to make expensive investments in order to comply with aggressive emission standards.

II. U.S. Inaction is No Longer a Rational Option

Today, economic fears remain the number reason why global warming skeptics are against aggressive measures to reduce greenhouse gas emissions. However, economic fears are no longer a sensible reason for inaction either. Economists are in the early phase of determining what the true financial costs of global warming may be. The conclusions from these initial studies are staggering and support the hypothesis that inaction is irrational.

The remainder of this chapter will focus on the United States and layout the reasons why inaction can no longer be justified. While much of this discussion will revolve around economic consequences of inaction, there are three general topic areas to support aggressive action against global warming:

1. **Economic Opportunities.** Undeniably, there will be risks associated with an aggressive campaign to shift our energy economy away from fossil fuels to one that is cleaner and more sustainable. However, economists and policymakers often overlook the enormous potential for economic prosperity and the corresponding costs of inaction.

   At the state level, California offers one example where aggressive policies and investments have been economically beneficial. Over the past 30 years (while the U.S. government has failed to take decisive action on global warming), the state of California (whose populous and economy is larger than many nations) has invested in newer, cleaner, and more energy efficient technologies (Kammen, 2007). At the same time, California has shutdown many outdated and polluting coal-fired electric generating plants (Kammen, 2007). As a result, California's energy use per person has remained constant for over 30 years while they have grown jobs and their economy has surged. Moreover, as a state, California is going to beat the targets established by the Kyoto Protocol.

   On the other hand, the state of Michigan offers a stark contrast. In the 1970s Michigan decision makers bet against global warming and a surge in oil prices. They continued to ignore the opportunity to invest in energy efficiency and cleaner technologies. Detroit automakers in particular carried on with a business-as-usual scenario and today the state is mired in dept and staring at an uncertain future (Rabe, 2007). While Detroit's problems run deeper than their shunning of global warming (i.e. union demands, pension plans, foreign competition), it is certainly a major factor in their problems of today.

   At a national level, Denmark provides a good example of how countries can prosper with aggressive policies and actions to thwart global warming. Denmark embraced homegrown, renewable energy in the 1970s and today they are world leaders in wind energy technology. Over 20% of Denmark's electricity comes from wind energy (compared to only 0.7% in the U.S.) and the industry provides more than 20,000 jobs and the Danish company Vestas controls over 35% of the market in the manufacture and sales of wind turbines (Schulte, 2007). Denmark is also revered for their global stewardship and this cannot be overlooked as another important reason why reducing carbon emissions can be beneficial.

On a global level, the 2006 Stern Review, published by the United Kingdom's Treasury Department, concluded that inaction today could cause economic and social disruption equal to the World Wars and economic depression experienced in the early part of the 20th century. The Stern Review estimates that an investment of 1% of GDP per year over the next 10-20 years could avoid the most catastrophic consequences of global warming (Stern, 2007). On the other hand, if the global community continues with a business-as-usual scenario the cost of global warming could reach 20% of annual GDP "now and forever" by the latter part of the 21st century (Stern, 2007). Clearly, action today demonstrates moral integrity, judicious decision-making, and fiscal responsibility.

2. **The Oil Crisis.** In the U.S., oil consumption is the number one contributor to global warming – even more than burning coal for electric power generation (Klare, 2005). Roughly, 45% of our carbon dioxide emissions come from burning oil through the transportation sector (Klare, 2005). However, U.S. dependency on oil is not only a global warming problem, it is also a geopolitical problem. In fact, America's dependency on oil (especially on foreign oil) can be characterized as a crisis. Oil provides 40% of our total energy needs; however, we do not have enough of our own supply to meet a 20 million barrel per day (bpd) consumption rate (Roberts, 2004; The National Commission on Energy Policy, 2004). This is not a new situation: domestic demand exceeded supply in 1946 when for the first time the United States became a net oil importer (Roberts, 2004). Our reliance on foreign oil became more pointed in 1970 when domestic production peaked at 9.6 million bpd and has steadily declined since (EIA, 2003). As a result, America's reliance on foreign imports is growing annually: our demand continues to increase while our domestic supply decreases (Riley, 2004). Today, we are forced to import a staggering 12 million barrels of oil every day (Roberts, 2004). This problem of foreign oil dependency has become a crisis for several reasons:

i. Global competition for diminishing oil supplies is intensifying. Global demand is forecasted to increase by 50% by the year 2025 (The National Commission on Energy Policy, 2004). However, since 1995, the world has consumed 24 billion barrels of oil annually while discovering only 9 billion barrels of new oil annually (Roberts, 2004). The competition for remaining oil is exacerbated by the fast growing economies of China and India who are aggressively pursuing a seat at the oil bargaining table. To say the least, this places the United States in a vulnerable situation.

ii. It is a geologic fact, global oil production will peak and no longer be able to meet global demand. This is known as Hubbert's Peak and no one knows with a high degree of certainty when this "peak" will occur. Some geologists, industry analysts, and government officials believe that Hubbert's Peak will be reached soon, possibly even this year, while the majority predict sometime between 2010 – 2015 (Hirsch, 2005; Roberts, 2004). Whenever peak production is realized, it will cause oil prices to rise suddenly and dramatically; most forecasts predict oil prices will rise to over $100 per barrel and stay there permanently (Klare, 2005; Roberts, 2004). For our society and economy that is dependent on cheap oil, this price spike would slow manufacturing, transportation, and most commercial activity while causing the cost of goods and services to increase (Roberts, 2004). In the words of author Paul Roberts (2004), this would drive the "entire economy into an enduring depression that would make 1929 look like a dress rehearsal." According to Hirsch et al. (2005), this dreadful scenario can be mitigated but preparations must be initiated at least 10 years in advance of peak oil. Currently, the U.S. is not making significant preparations towards a post oil energy economy.

iii. Crude oil is now over $60 per barrel (compared to an average of $17 per barrel in 1999), meaning that every barrel of high priced oil that we import is adding to our record high trade deficit that is approaching $700 billion annually (Bureau of Economic Analysis, 2005).

iv. Buying foreign oil transfers enormous amounts of money from our national treasury to politically unstable oil-rich regimes that financially support some of the most brutal and anti-American networks in the world. Publicly, this has become a salient irony since the terrorist attacks of 2001.

v. Defending our foreign oil supplies is a risky proposition. While the role of oil in our recent military campaigns in the Middle East is debated, oil certainly has *something* to do with it. Protecting our foreign oil supply with military force is not clandestine. In the 1980 State of the Union address Jimmy Carter warned "let our position be absolutely clear: an attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America. And such an assault will be repelled by any means necessary, including military force" (Jimmy Carter Library, 2004). The Carter Doctrine (as it is now called) still guides American foreign policy. For Americans, war is perpetually on the horizon. Any doubters should compare the world's largest oil reserves with the location of our international military presence.

America's growing dependence on oil threatens our economy, national security, and our quality of life. These issues cannot be thought of separately from oil's contribution to global warming: they are one of the same because they all threaten our long-term sustainability as a prosperous nation. Overall, switching our energy economy away from oil to newer, cleaner, more sustainable technologies is all-around good policy.

3. **Surprises.** Future climate projections are based on complex global climate models. Unfortunately, climate modeling is an inexact science. In fact, it is an art-form replete with uncertainties and assumptions. When scientists are faced with uncertainties and forced to make assumptions, they will, by nature, err on the side of caution. In other words, scientists do not like to be wrong and they inherently reduce their probability of making a mistake. In the case of predicting Earth's future climate regime, scientists favor assumptions that reduce the severity and potential impacts of global warming (because they can be more confident that these predictions will actually happen). The result of this is that the impacts of global warming – discussed in Chapter 2 – are *conservative* predictions of what is likely to happen. In other words, 21st century reality could be much worse. In fact, the U.S. National Assessment Synthesis Team (2001) states that the chances of unanticipated negative impacts from climate change are

"very likely." These are often referred to as "surprises" and they may result in dramatic and irreversible consequences unforeseen in future climate predictions. Future "surprises" are likely to occur from three different sources:

a. ***Uncertainty.*** Climate models attempt to numerically represent the biological, geological, and chemical processes of Earth's environment as it relates to the sun and other influences (such as volcanic eruptions) (Berliner, 2003). This translation is imperfect and increases uncertainty in the models conclusions.

But, this is not the only type of uncertainty. Climate scientists are faced with others. And when they are, they are forced to make assumptions. In the case of climate modeling, assumptions are made for several reasons. First, the global climate system is very complex and only partially understood. For example, important aspects of the complex flow of carbon between the Earth's soils, its plants, the oceans, and the atmosphere are still unknown (Schiermeier, 2007). Other critical uncertainties include the ocean's ability to uptake CO_2. A leading hypothesis suggests that as atmospheric CO_2 increases, it causes the ocean to acidify, reducing its ability to absorb more carbon (Schiermeier, 2007). Obviously, if this is true, it will cause an increase in the greenhouse effect. The point is, the ability of the ocean to uptake carbon under a warmer climate regime is largely unknown. Perhaps the single largest source of uncertainty involves cloud feedback. Clouds can both reflect incoming solar radiation (having a cooling effect) or they can block reflected radiation from escaping back into the atmosphere (having a warming effect). How clouds influence the climate depends on their density, height, form, and location (Karl & Trenberth, 2003). Again, this is a significant source of uncertainty for climate predictions.

Second, climate modelers depend on climatic records from the past. Unfortunately, these data are often incomplete or inaccurate. The work of paleoclimatologists, for example, is like that of a detective. They often have to base their conclusions on limited and sometimes insufficient evidence. As a result, paleontologists are forced to make assumptions; and, these assumptions become part of the data used by climate modelers.

Third, inevitable assumptions stem from the fact that what is happening to the Earth's climate today is unprecedented (see Chapter 1). No one knows how the Earth's climate system will react to anthropogenic warming – we are embarking in uncharted waters. Some people refer to global warming as humanity's experiment with Earth's climate system. However, by no means is anthropogenic climate change a controlled experiment; we know of no other planets similar to Earth to use as reference (Berliner, 2003). Therefore, computer modelers have to assume that the climate system will behave in a certain way without much verification. These are some of the reasons why climate projections based on global climate models are replete with uncertainties and assumptions.

b. ***Positive Feedback Loops.*** When climate modelers do not scientifically understand certain climatic events or interactions, they often exclude this "uncertainty" from their calculations. In other words, some important characteristics of the global climate system are not factored into climate models. Climate feedback effects are a case in point. Relatively little is known about them and how they might enhance (or weaken) the rate and overall effects of climate change (Schiermeier, 2007). So, how does the scientific community deal with this situation? They exclude some feedback effects from their calculations. For example, the Intergovernmental Panel on Climate Change explains how they decided to exclude information on the climate-carbon cycle feedback because there is too much uncertainty and the data that is available is unpublished (IPCC, 2007b).

Excluding positive feedback systems from climate calculations is especially worrisome for two main reasons: 1) they are likely to occur; and 2) when they do occur they will result in climate impacts that will likely exceed the impact projections mentioned in Chapter 2. In other words, positive feedback systems are likely to result in greater warming, higher sea-levels, faster rate of melting ice, more hurricanes, etc., than those predicted by the Intergovernmental Panel on Climate Change and other climate assessment teams. Examples of positive feedbacks include:

- The water vapor feedback. Water vapor is by far the most powerful contributor to the greenhouse effect. When atmospheric temperature increases, the amount of water vapor the atmosphere can hold also increases (Karl & Trenberth, 2003; Lorius et al., 1990). This positive reinforcing cycle will significantly amplify the global warming affect. However, because this affect is not fully understood it is not factored into future climate projections.

- Ice-albedo feedback. Another commonly known positive feedback loop occurs with the melting of snow and ice. Snow and ice (and other brightly lit surfaces reflect the sun's radiation having a cooling effect. When snow and ice melts (as a result of global warming) this bright surface is replaced with a darker surface that absorbs and further heats the planet (Karl & Trenberth, 2003). Of course, a warmer planet further increases the rate at which snow and ice melt. The result? A classic positive feedback loop.
- Atmospheric CO_2. As we have discussed, when atmospheric levels of CO_2 increase so will global temperature. When global temperature increases it reduces the ability of the land and ocean to absorb CO_2, thereby increasing the amount in the atmosphere, causing further warming. Another frightening example of a positive feedback loop that can increase the greenhouse effect beyond most 21^{st} century predictions.
- Forests fires. Longer, drier summers will continue to increase the rate and severity of forest fires. When trees burn carbon is released into the atmosphere, further contributing to longer, drier summers.

c. ***Thresholds***. The most complex and widely used global climate models all assume that climate change is linear. That is, climate trends will move in a steady and predictable direction. However, paleontologists and climatologists know that this is not true. The climate has thresholds and once they are breached abrupt and extreme climate events can occur. For example, scientists assume that the rate at which the Greenland Ice Sheet will melt, and the amount of freshwater flowing into the North Atlantic, will remain somewhat constant. As a result, they predict that the slowing of the global ocean conveyor belt will also occur in a predictable and corresponding manner. However, neither of these assumptions may be true. In particular, the North Atlantic Ocean current may have a temperature and freshwater threshold that once crossed could cause this section of the global ocean conveyor belt to shut down resulting in catastrophic climate change. However, the dynamics involved are so complex and there is so much scientific uncertainty that scientists use the most conservative and reliable data. This approach caused the Intergovernmental Panel on Climate Change to conservatively conclude in their Fourth Assessment Report (2007a) that an abrupt transition of the North Atlantic ocean current is “very unlikely” in the 21st century but slowing of the ocean current is also “very likely.” Another threshold involves the arctic tundra. Currently, the tundra acts as an important carbon sink, however, there is scientific evidence suggesting that there is a warming threshold that when breach may turn the tundra into a carbon source (Schiermeier, 2007).

Uncertainty, positive feedback loops, and thresholds have not been factored into future climate projections. Certainly, they will increase the consequences and therefore the economic costs of global warming.

III. Chapter Summary

Over the past 100 years, scientific uncertainty, the pervasive belief that global warming was relatively benign, and economic recession have all been major reasons why decisive action has yet to be taken to combat global warming. The 2007 Intergovernmental Panel on Climate Change report put to rest any reasonable doubt that human activities are contributing to global warming. The scientific community has also made it quite clear that the consequences of global warming will be severe unless greenhouse gas emissions are reduced. Today, economic fears remain the number one reason why global warming skeptics are against aggressive measures to reduce greenhouse gas emissions. However, the science is absolutely clear: the impacts of global warming will occur for decades and perhaps centuries, whether society prepares for it or not. Societies that do prepare, can achieve economic growth and sustainability. Those that do not will face increasing geopolitical and economic costs as the impacts of global warming increase their intensity.

Most importantly, no one knows how warm Earth can get and how severe the true consequences may be. But, one thing is certain; every day that passes without aggressive action to thwart greenhouse gas emissions increases the likelihood of climate “surprises.” As the Intergovernmental Panel on Climate Change so clearly points out in their Fourth Assessment Report (2007a), impacts and economic costs will continue to increase with global average temperature. We already know that past anthropogenic greenhouse gas emissions will contribute to warming and sea-level rise for centuries into the future (IPCC, 2007a). Society can no longer wait to reduce emissions; the global community must take action today to slow the rate of climate change. For all of these reasons, avoiding decisive action to combat global warming is irrational at best, and a crime against humanity at worst.

PART II

EVERGREEN'S

GREENHOUSE GAS INVENTORY

CHAPTER 4
The Evergreen State College Commits to Reducing Greenhouse Gas Emissions:
The Goal of Carbon Neutrality by 2020

I. Higher Education's Obligation to Fight Global Warming

"Leading society to reverse human-induced global warming is a task that fits squarely into the educational, research, and public service missions of higher education. There is no other institution in society that has the influence, the critical mass and the diversity of skills needed to successfully make this transformation."

Presidents Climate Commitment, A Call for Climate Leadership, 2007

In many ways fighting climate change is one of the greatest and most perplexing challenges humanity has ever faced. The international community's most concentrated effort to reduce greenhouse gas emissions – the Kyoto Protocol – is in obvious need of amendment, as few nations will meet their target. Moreover, most scientists agree that global emissions need to be reduced 80% by 2050 in order to avoid the most serious impacts of climate change (Porter et al., 2000). This means that even if the Protocol succeeded it would be far too little. It would take an additional 30 to 80 Kyoto Protocols to stabilize global emissions (Goldberg, 2007; Kammen, 2007); humbling, since the international community cannot accomplish one. Furthermore, the U.S. continues to increase annual emissions, and China is planning on building one new coal-fired power plant per week for the next several years. Finally, even if emissions were somehow stabilized at 2000 levels, our planet will continue to warm and sea-level will continue to rise for decades (perhaps centuries). Clearly, the situation is problematic.

Faced with this reality, some economists and U.S. policymakers simply throw up their arms believing that mitigation is too costly and too late. They argue that adaptation is the better policy now. However, because there is no known upper limit on how severe the impacts of global warming may get and because we know that the fiscal costs of climate change will continue to increase with emissions, adaptation without mitigation is a dangerous public policy. Simply put, this way of thinking threatens societies' long-term viability.

What is needed is a new way of thinking. It is time for skeptics, laggards, and pessimists to step aside and make way for proactive leadership. Thinking about climate change in a new way must be pervasive and infiltrate all levels of society. Additionally, the effort to fight climate change must be sustained – there is no quick fix to this problem. It will take aggressive research, technological innovation, whole systems thinking, and a much higher degree of environmental and ecological literacy. Clearly, these criteria fall directly into the purview of higher education. Without higher education's dedicated effort to fight global warming, society will be less capable of slowing the rate of warming and less capable of dealing with its effects. Let us examine the reasons why.

First, higher education is a powerful economic force. Currently, over 4,100 U.S. colleges and universities employ over 1.2 million faculty and enroll over 17 million students (National Center for Education Statistics, 2005). Obviously, this creates huge economic leverage. In fact, the higher education sector is a $315 billion industry (National Center for Education Statistics, 2005) with billions being spent every year purchasing fuel and energy (The Apollo Alliance, 2005). Imagine if all U.S. institutions of higher education purchased 100% renewable energy – it would increase demand, increase production, lower the cost of manufacturing, and lower the overall purchasing cost. We have witnessed this trend in western Washington State. In 2005, The Evergreen State College and Western Washington University initiated a policy to offset 100% of their energy use by purchasing Green Tags[8]. The University of Washington (a much larger institution) followed suit by also agreeing to a 100% renewable energy policy. Suddenly, Puget Sound Energy had a huge customer-base interested in clean, renewable energy. Consequently, the cost of Green Tags and the cost of renewable energy have been substantially reduced. At the same time, the amount of investment targeted for new production of renewable sources or energy has grown exponentially which has increased production. This is a win-win-win situation for producers of renewable energy, Puget Sound Energy, and the region in general. This example demonstrates how the purchasing power of higher education can be used to reduce greenhouse gas emissions.

Second, our country's future political leaders, CEO's, engineers, architects, developers, scientists, lobbyists, business-owners, and educators are currently enrolled in college. Imagine if their educational experience included a robust practical and philosophical training in sustainability. If institutions of higher education incorporated a 100% renewable energy portfolio, they would become working models for every student

[8] Specific information about Green Tags can be found on their website: www.greentagsusa.org

that passed through their doors. If past graduates have led us down this unsustainable path – partly because they are energy and ecologically illiterate – then future graduates can be expected to help society change course towards a better, more sustainable energy economy (Cortese, 2003). No matter what economic sector they eventually find themselves in (or what level of employment) they would be prepared to contribute knowledge and ideological support towards sustainable planning.

Third, reversing global warming requires the advancement of renewable energy technologies such as solar, wind, geothermal, hydrogen fuel cells, biofuels, and others. Few institutions in the world are better situated for cutting-edge research than colleges and universities. Housed within academic institutions are some of the most innovative and brilliant minds in the world. They benefit from tax-free status, academic freedom, and are the recipients of billions of dollars annually in endowment funds (Cortese, 2003).

Fourth, solving the problems created by global warming and working to reduce emissions will take a motivated, interdisciplinary, and collaborative effort. Who else contains such a diverse level of brainpower and expertise in a central location? Moreover, the collegiate student body is highly motivated and creative. Already, tens of thousands of students in collaboration with faculty, staff, and community neighbors are forming new climate action groups, lobbying their administrators, fostering new community partnerships, and implementing innovative solutions to reverse global warming (Dautremont-Smith et al., 2006).

Fifth, many colleges and universities embrace a civic duty and moral responsibility to strengthen society and contribute to the public good. As former Vice President Al Gore so fervently reminds us, global warming is a moral issue (Gore, 2006). And, the latest Intergovernmental Panel on Climate Change Report (2007a) makes it clear that the most underprivileged people in the poorest nations are likely to be the most adversely affected by climate change.

Reducing greenhouse gas emissions 80% by 2050 is the greatest challenge of our time. Any chance of accomplishing this – and therefore overcoming the worst impacts of global warming – requires a new way of thinking, will take a fundamental transformation in the way society is organized, an overhaul of our economic system, landmark shifts in public policy, considerable investments in new infrastructure, considerable investments in research and development (in the hopes of inventing or advancing existing technologies), and extensive conservation efforts. And this must all be accomplished within one generation. Higher education has the influence, diversity of expertise, civic duty, motivation, and fiscal resources to be leaders in the fight against global warming. And, therefore, has a critical role to play. As Tony Cortese (2003) of Second Nature so provocatively asks, "If higher education does not lead this effort, who will?"

II. The Goal of Carbon Neutrality at The Evergreen State College

If higher education must play an important role in fighting climate change, then The Evergreen State College is welcoming the responsibility. To start, Evergreen began purchasing 100% green energy in 2005. Which, according to the EPA, made it the 8th largest purchaser of green energy in the country by January 2006 (EPA, 2006a). However, this is nothing new, Evergreen has long been dedicated to environmental education and social activism. Moreover, Evergreen is widely known as a premier liberal arts college focused on interdisciplinary, collaborative learning. Evergreen's faculty members are highly principled, they focus on teaching, and they strongly encourage student participation. Indeed, students are active participants in the learning process (not passive recipients of information). Through individual learning contracts, students have the added opportunity for community-based learning where turning theory into practical application is routine. It is just this mix of institutional principles that fosters sustainable thinking. As a result, Evergreen's faculty, staff, and students have established themselves as leaders in the field of sustainability and have taken a prominent role in the fight against global warming.

Evergreen is one of the first institutions in the country to establish the all-important goal of becoming carbon neutral by 2020. Evergreen's story of carbon neutrality begins with the formation of the Sustainability Task Force. Evergreen's President and Vice Presidents created the Task Force in 2005 following three summers of faculty-initiated sustainability institutes. Members of the Task Force include the director of institutional planning and budgeting, the director of purchasing, the director of residential and dining services, the college engineer, ten faculty members, and two students. The initial charge of the Task Force was to create a long-term plan intended to guide the Evergreen community to a sustainable future. This "plan" was to become the new sustainability section in the College's five-year Strategic Plan. As far as institutional planning goes, the strategic plan is an ideal place for sustainability. The Strategic Plan identifies Evergreen's core values, guides operations, and is closely linked to budget allocations. I became the first coordinator of the Task Force shortly after it was created. Therefore, in many ways, Evergreen's story of carbon neutrality is a personal story. I have either been involved with or a firsthand witness to the major events that have led to this goal.

As a Task Force, we spent our first year organizing, collecting information, and writing Evergreen's long-term sustainability plan. We realized that in order for our plan to be both meaningful and enduring we had to engage a large cross-section of the Evergreen community. Accordingly, we developed a broad-based community outreach program asking what sustainability means to the people at Evergreen. We realized that it would be difficult to engage a diverse and busy population in our deliberations. So, we chose several different methods that would bring a large number of people into the conversation. These included one-on-one interviews with faculty members, interviews with students and student groups, well-designed student workshops that were facilitated within academic programs, initial visits to sector staff meetings culminating in a cross-campus staff institute, interviews with key administrators and decision-makers at the college, and an online web survey.

Thinking about all of these different forms of engagement with our many diverse community members, we needed to have some measure of consistency. This would be especially critical when it came time to analyze the feedback from our engagements. Therefore, we chose three central themes for our questioning. These were:

- What is your current perception of sustainability at Evergreen?
- What should a sustainable Evergreen look like in the future?
- How do we make the transition from your current perception to your future vision?

By the time Spring Quarter 2006 was over, we had face-to-face interactions with over 380 employees and students. This generated a tremendous amount of feedback and provided directive and great insight as we labored toward our final report.

Attempting to manage and make sense of all this data, the Task Force divided itself into working groups. Each focused on a different constituent of the Evergreen community (i.e. students, faculty, staff, and administration). Next, each working group prepared a synthesis report, and the Task Force convened for a day-long retreat to organize and discuss the results.

Based on the community feedback and insights of the Task Force members, several key strategies and goals emerged[9]. They included:

[9] The Sustainability Task Force's complete report with its full complement of strategies and goals can be viewed online at: www.evergreen.edu/committee/sustainability/interimreport.htm

- Establish a curricular pathway in sustainability
- Increase opportunities for a practical education in sustainability
- Initiate a robust plan for the reduced and efficient use of resources
- Examine and implement best sustainable practices/purchases policies
- Increase communication and assemble the history behind Evergreen's sustainability goals, achievements, and indicators
- Manage Evergreen's land endowment for increased biodiversity and maximum educational opportunities related to sustainable practices
- Strengthen bonds and relationships among all Evergreen's programs
- Strengthen bonds and relationships with Evergreen's neighbors and greater community region
- Improve campus spirit and internal wellness and foster healthy relationships
- *Become a carbon neutral college by 2020*

In essence, the strategies and goals represented in the final Task Force report are a product of the entire Evergreen community. Of all the details in the report, the goal of carbon neutrality has spawned the most discussion and has generated the greatest level of excitement. The majority of the Evergreen community and Task Force members believe that if our institution cannot achieve carbon neutrality, then we have failed to achieve sustainability. In other words, carbon neutrality is a key indicator of Evergreen's progression towards a sustainable future. The reason is simple: Evergreen's greenhouse gas emissions contribute to global warming which threatens our economic viability, threatens the services that our ecosystem provides, and exposes social and environmental inequities. On the other hand, balancing Evergreen's carbon budget would indicate that college operations and community activities were no longer contributing to global warming.

By the end of 2006, the Sustainability Task Force's recommendation to become a carbon neutral college by 2020 had been approved by Evergreen's President, the Vice Presidents, and by the Board of Trustees; thereby, becoming official college policy.

In October 2006 (at the time when the Task Force's Sustainability Report was going through the approval process), seven members of the Task Force attended the largest campus sustainability conference in the history of North America. More than 650 faculty, staff, and students representing 44 states and 4 countries gathered at Arizona State University to attend the Association for the Advancement of Sustainability in

Higher Education (AASHE) meeting. The purpose of the conference was for academic institutions to come together to share information and demonstrate how higher education can lead the way to a sustainable future. A central theme of the conference was global warming.

One speaker's message was particularly affecting. Eban Goodstein (faculty member in economics at Lewis and Clark College) called all to action. He is using his sabbatical to organize a year-long nationwide discussion on global warming solutions that will culminate with a national teach-in on January 31, 2008. It is called *Focus the Nation* and it fits really well with Evergreen's intention to raise community and regional awareness on the issue of global warming. Therefore, the Sustainability Task Force embraced *Focus the Nation* and is helping the Evergreen community in planning for this event.

As 2006 came to a close, another initiative emerged also with a focus on global warming. A number of college and university presidents were organizing a campaign called the Presidents Climate Commitment[10]. Modeled after the U.S. Mayor's Climate Protection Agreement, the Presidents Climate Commitment is a call for college and university presidents to commit to a carbon neutral policy. The goal is to have a commitment from 200 college and university presidents by June 2007 and 1,000 by the end of 2009 (Dautremont-Smith et al., 2006).

Throughout 2006, members of the Sustainability Task Force became aware of two significant realities that relate to Evergreen's role as a national leader in sustainability.

First, the October AASHE conference clearly reconfirmed that Evergreen's institutional approach to the teaching and practice of sustainability places us at the forefront of advancing sustainability on campus. For example, very few colleges have sustainability as a key component of their institutional strategic plan, have a committee devoted towards advancing sustainability on campus, offset 100% of their energy purchases with renewable sources, have a LEED certified Gold building on campus, have the opportunity for students to put sustainability theory into practice through individual learning contracts, and have a built-in collaborative, interdisciplinary teaching philosophy that is essential to sustainable thinking. While these examples represent only a portion of Evergreen's overall dedication to sustainability, taken as a whole they certainly indicate a

[10] Detailed information on the Presidents Climate Commitment can be found online at www.presidentsclimatecommitment.org

high level of dedication to sustainability and place Evergreen among the most progressive in the advancement of sustainability.

Second, it also became quite obvious that the Evergreen community was not effectively communicating our sustainability accomplishments within our community, region, and country. In other words, Evergreen was not living up to its capability as a community and national leader on the issue of climate change despite the fact that we were well-positioned to do so. An unfortunate result of this is that our consultation is not extensively sought within South Puget Sound and among the national collegiate community.

The combination of these factors prompted the Sustainability Task Force to devote significant energy to raising awareness and educating others on the issue of global warming. Task Force members also realized that, as an institution, we could not consider ourselves a regional and national leader without proactive leadership measures from our administration. Therefore, the Task Force initiated a meeting with Evergreen President Les Purce to ask for his support.

On January 17, 2007 we met with President Purce and requested two actions in relation to global warming:

1) **Support Evergreen's efforts in promoting and organizing for the "*Focus the Nation*" event.** The Sustainability Task Force envisions a large community event held in a prominent location that will bring our regional community together to raise awareness and discuss solutions regarding impending threats associated with global warming and climate destabilization. We asked President Purce for his commitment to help the Task Force promote and organize for this event. We explained how this would better demonstrate Evergreen's leadership in the region and be further recognized as an institution that can provide expertise on issues of sustainability.

Without hesitation President Purce asked the Task Force members to draft up a memo explaining how he would invite local colleges and universities to join Evergreen in making January 31, 2008 remarkable. Additionally, President Purce sent an all-campus email stating, "For my part, I will take a personal role in raising the regional and national visibility of global warming issues by reaching out to higher education institutions in our region and to leaders in the community, in an effort to generate broad-based momentum for *Focus the Nation*."

2) **Join the "Leadership Circle" of the American College & University Presidents Climate Commitment.** Because Evergreen already established the goal of

carbon neutrality and was therefore ahead of most other institutions in their thinking on the issue, we asked President Purce to become one of the founding members and key supporters of the Presidents Climate Commitment. This is known as the Leadership Circle and was intended to be made up of 15-25 presidents. Task Force members believed President Purce's membership on the Leadership Circle was important for a few different reasons:

a. **A national leader from the outset:** Undoubtedly, Leadership Circle presidents are going to receive nationwide recognition for their institutions and for their leadership on addressing global warming. This recognition will be a clear indicator that Evergreen is a leader in sustainability.

b. **A valued member of the Leadership Circle:** Evergreen's decentralized organization, distinctive philosophical approach to education, and rich history of sustainable thinking would add to the diversity of the Leadership Circle. Among other benefits, this would ensure another unique perspective in institutional planning for reductions in greenhouse gas emissions.

c. **Increased morale:** The Sustainability Task Force considers global warming to be the number one threat to a sustainable future. President Purce's membership on the Leadership Circle would signify to the Task Force (and our community as a whole) that our President also considers global warming to be an imposing threat to our society. To be sure, this would lead to an increased recognition of the problem throughout our community and result in an increased devotion to address the problem.

d. **Evergreen is well-positioned to achieve the Presidents Climate Commitment and be a leading institution of the pledge:** Signatories of the Presidents Climate Commitment will agree to: 1) plan for climate neutrality; 2) create an appropriate infrastructure to guide in the development and implementation of a climate neutral plan by late 2007; 3) complete a comprehensive carbon inventory by the middle of 2008; and 4) create an institutional action plan for becoming climate neutral by 2009. In light of the actions already taken at Evergreen these target dates and goals are "soft." In other words, Evergreen has already committed to carbon neutrality by 2020; the Sustainability Task Force already provides

> the necessary infrastructure to guide in the development of a carbon neutral plan; and a comprehensive carbon inventory is the subject of my thesis and will be completed by June 2007. It is obvious that Evergreen is already a leading institution in addressing global warming and the Presidents Climate Commitment is entirely achievable. However, achieving carbon neutrality in isolation will be of little educational value to our community and the academic world as a whole.

Once again, President Purce agreed with this rationale and within days had completed the Presidents Climate Commitment "Letter of Intent." President Purce is now a member of the Leadership Circle.

When Evergreen's President, Vice Presidents, and Board of Trustees accepted the Sustainability Task Force recommendation to become carbon neutral by 2020, when President Purce and the Sustainability Task Force took on a leadership role in planning and organizing for *Focus the Nation*, and when President Purce signed on the Leadership Circle of the Presidents Climate Commitment, Evergreen firmly committed itself to the goal of carbon neutrality and the fight against global warming.

III. The Rationale Behind Evergreen's Carbon Inventory

Can Evergreen achieve carbon neutrality by 2020? The answer is somewhat of a mystery. When the goal was established, Evergreen had never officially calculated its carbon emissions, and therefore, had no quantitative data as to where and at what levels our emissions were coming from. The truth is, Evergreen knows very little about its emissions and contribution to global warming. Without this information, attaching a timeframe to the goal is a bit presumptuous. Certainly, calculating Evergreen's carbon emissions would have been a reasonable first step. Then, Task Force members would have had more insight prior to determining a specific climate policy and timeframe. However, completing a carbon inventory is not exactly a strategic goal and by itself does not reduce emissions. In other words, a carbon inventory is not a final goal; rather it is a critical first step in the process. In terms of Evergreen's Strategic Plan, completing a carbon inventory would be an action step in route to achieve the ultimate goal of carbon neutrality. This is why the goal was established before the inventory.

Because the goal and the timeframe are somewhat arbitrary, one might also wonder why carbon neutrality was picked at all. After all, some other institutions that have passed a climate policy have decided on a reduction of greenhouse gas emissions over a specified period of time[11]. For example, Bowdoin College in Maine established a policy of 11% below 2002 emissions to be achieved by 2010. So, why did the Sustainability Task Force decide on a carbon neutral policy? Well, members of the Sustainability Task Force consider carbon neutrality to be a minimum goal. It means that once achieved the institution will have a net-zero impact on global warming. More specifically, carbon neutrality means that the institutions emissions through operations and daily activities are balanced by other activities that offset or remove greenhouse gases from the atmosphere. If every nation, institution, organization, and individual accomplished this, then the human contribution to global warming would be stopped. With that being said, we do not know at what level this could be achieved. For example, on a global basis, if carbon neutrality is ever reached this could happen at 500, 600, or 1,000 ppm. In other words, achieving carbon neutrality does not necessarily mean the problem of global warming has been solved; only that society is no longer contributing to further warming. This is one reason why it should be considered a minimum goal and became the goal specified by the Sustainability Task Force.

Another reason why carbon neutrality was the goal favored by Evergreen's Sustainability Task Force was because it is easier to conceptualize on an annual basis. Because carbon neutrality means balancing Evergreen's carbon emissions with its carbon sinks, the institution can evaluate its contribution to global warming on an annual basis. On the other hand, establishing a goal of say 10% below 2000 levels by 2010 without the concurrent goal of achieving carbon neutrality, may or may not look at sinks or offsets. Ultimately, carbon sinks and offsets will be a critical part of any climate policy and must also be measured. Additionally, comparing future emissions with an arbitrary baseline year may not account for institutional growth or major changes. Both can influence the level of emissions causing the undue failure *or* success of the policy. This has been a major roadblock in the Kyoto Protocol. For example, Russia and Ukraine's 1990 emissions were accounted for, but after their economies declined they had virtually no chance of failing to meet their specified reductions. On the contrary, the United States found it nearly impossible to meet their specified goal within the timeframe required because the U.S. economy continued to surge. Initially, the goal of balancing each nation's carbon budget may have been a better policy. Learning from this, the Task Force decided on a carbon neutral policy. Ultimately, the goal of carbon neutrality not

[11] A list of U.S. college and university commitments to climate change can be accessed from the AASHE website at http://www.aashe.org/resources/gw_commitments.php

only necessitates a reduction of emissions but also necessitates increasing carbon sinks and/or offsets.

V. Chapter Conclusion

Clearly, higher education has a fundamental role if global and especially U.S. greenhouse gas emissions are going to be brought under control. The Evergreen State College has taken responsibility for global warming by making an institutional commitment to reach carbon neutrality by 2020. This is one of the most aggressive climate policies of any college or university in the United States. An initial step in the process of achieving carbon neutrality is to complete a comprehensive greenhouse gas inventory.

CHAPTER 5

Understanding Evergreen's Carbon Inventory

Climate policies are pervasive. Nations, governments, cities, businesses, organizations, and of course, institutions of higher education have all established goals to reduce greenhouse gas emissions. As mentioned in the previous chapter, the first step in accomplishing any climate policy is to complete a carbon inventory. Understanding the basic concepts and calculations of the inventory is not only important for the individuals carrying out the methodology but is also important for anyone interested in what the inventory is telling us and how the results where derived. In this chapter I will discuss: 1) understanding the basic concepts and calculations behind the methods and 2) the decision to use the Clean Air-Cool Planet Campus Carbon Calculator.

I. Basic Concepts and Calculations of the Carbon Inventory

Evergreen's policy of carbon neutrality is actually a bold statement indicating that the college will no longer contribute to global warming by 2020. A critical step in achieving this goal is to quantify Evergreen's current contribution to global warming. This is accomplished by completing a carbon inventory. A carbon inventory will reveal an institutions net greenhouse gas emissions (total emissions minus the sum of its offsets). Offsets can be any process or activity that removes greenhouse gases from the atmosphere (i.e. forest productivity, composting, etc.) or any strategy that increases the amount of energy produced from clean, renewable sources (i.e. purchase of "Green Tags" or any other green electricity investments). A carbon inventory produces a greenhouse gas budget. Because The Evergreen State College initiated a policy of carbon neutrality the goal is to balance our greenhouse gas budget at zero. In other words, where total emissions equal total offsets. Once armed with a greenhouse gas budget, the Evergreen community can make informed decisions on how to reduce its emissions and increase its offsets in order to achieve net-zero emissions.

Evergreen's contribution to global warming will be measured in the internationally recognized units of metric tonnes of carbon dioxide equivalents (MTCDE). Therefore, it is important to understand what metric tonnes of carbon dioxide equivalents really mean and how it is derived. As a metric measure, a carbon dioxide equivalent is the amount of a greenhouse gas emitted multiplied by its radiative forcing or global warming potential (GWP). For Evergreen's inventory, I am interested in measuring each of the greenhouse gases specified by the Kyoto Protocol. These are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF_6) (UNFCCC, 2007). Therefore, it should be understood, without ambiguity, that Evergreen's goal is actually *climate* neutrality despite the stated goal of *carbon* neutrality.

Four important pieces of information are necessary in order to determine the metric tonnes of carbon dioxide equivalent for a particular energy source or activity that emits greenhouse gases:

1. The amount of activity or quantity of energy used over a specified period of time. Common units of measurement are: kWh (kilowatt-hours), MMBtu's (one million British thermal units), or any unit of weight, distance, or volume. For example, in 2006 Evergreen used 115,753.3 MMBtu's of natural gas, 16.5 million kWh of purchased electricity, and six thousand gallons of diesel fuel for transportation for the college fleet.
2. The greenhouse gases emitted from each activity or energy source. For example, Evergreen burns natural gas for the purpose of space heating and cooling. This process releases the greenhouse gases of carbon dioxide, methane, and nitrous oxide into the atmosphere.
3. The emissions factor for each greenhouse gas. The emissions factor is a measure of the average rate of emission of a particular greenhouse gas from a particular source. To clarify, it simply means that certain activities – whether it is converting coal into electricity, burning gasoline for transportation, or combusting oil for space heating and cooling – release different greenhouse gases into the atmosphere in different amounts. For the stationary internal combustion of natural gas, the emission factor (or rate of emission of greenhouse gas into the atmosphere) is 52.8 kg of CO_2, 0.00528 kg of CH_4, and 0.00011 kg of N_2O for every MMBtu of heat (EPA, 2006b). The U.S. EPA (2007) maintains a complete list of standard emission factors, which is available to the public and can be accessed from their website.

4. The global warming potential for each different greenhouse gas. The global warming potential is a measure of each gas's radiative forcing. The greater the radiative forcing the more potent the greenhouse gas. Carbon dioxide is used as the standard for which the other greenhouse gases are compared (hence the term carbon dioxide equivalent), and therefore, has a global warming potential of one. Methane has a global warming potential of 23 and nitrous oxide is more powerful yet with a global warming potential of 296. To explain in further detail, because methane has a global warming potential of 23, it means that one kilogram of methane has a radiative forcing that is 23 times greater than one kilogram of carbon dioxide over a 100 year period (EPA, 2006b). Table 1 lists the global warming potentials for additional greenhouse gases.

Table 1. *Global warming potentials for the greenhouse gases emitted through Evergreen's operations and daily activities.*

Greenhouse Gas	100 Year GWP
CO_2	1
CH_4	23
N_2O	296
HFC-134a	1,300

Once these four pieces of information are obtained, then metric tonnes of carbon dioxide equivalent can be calculated for any particular energy source or activity. For example, as stated above, Evergreen burned 115,753.3 MMBtu's of natural gas in 2006. Because natural gas emits carbon dioxide, methane, and nitrous oxide we need to multiply each gas's emissions factor by their global warming potential. Adding each of these three values together equals the emissions coefficient for the internal combustion of natural gas. Emission coefficients are fixed values and in the case of natural gas it is 0.053 metric tonnes of carbon dioxide equivalent. See Table 2 for the list of emissions coefficients used in Evergreen's greenhouse gas inventory. Multiplying the emission coefficient by the total amount of activity or energy used gives metric tonnes of carbon dioxide equivalent over the specified time period. In the case of natural gas Evergreen used 115,753 MMBtus in 2006. Multiplying 115,753 MMBtus by natural gas's emissions coefficient (0.053) equals 6,134.9 metric tonnes of carbon dioxide equivalent for 2006. This value was Evergreen's contribution to global warming in 2006 just from our on-campus stationary burning of natural gas. Adding each source of emissions (i.e. purchased electricity, air travel, commuter habits, etc.) in a similar manner will lead to Evergreen's total emissions of all greenhouse gases.

Table 2. *Emission coefficients (conversion factors) for the greenhouse gases emitted through Evergreen's operations and daily activities.*

Evergreen Activity		**Emission Coefficients**	
Electricity Consumption	Purchased Electricity	0.00054	MTCDE/kWh
Space Heating	Combustion of Natural Gas	0.05300	MTCDE/MMBtu
	Distillate Oil #2	0.01000	MTCDE/gallon
Forklift, Labs, Longhouse	Propane Use	0.00500	MTCDE/gallon
Transportation	Commuter Gasoline Use	0.00900	MTCDE/gallon
	Commuter Diesel Use	0.01000	MTCDE/gallon
	Air Travel	0.00078	MTCDE/mile
Agriculture	Swine (pigs)	0.35950	MTCDE/head
	Goats	0.14140	MTCDE/head
	Poultry	0.00483	MTCDE/head
Fertilizer	Organic	0.00380	MTCDE/lb
Solid Waste	Landfill	0.14670	MTCDE/short ton
Space Cooling	Refrigerant (HFC-134a)	0.59000	MTCDE/lb
Offsets	Purchased Green Tags	0.00054	MTCDE/kWh
	Composting	0.18000	MTCDE/short ton
	Forest Productivity	No Standard Rate	

II. Choosing The Clean Air-Cool Planet Campus Carbon Calculator v5.0

A "carbon calculator" is the most widespread and effective tool for analyzing an institutions greenhouse gas budget. While there are various organizations and government agencies that provide carbon calculators to the general public, my decision to use the Clean Air-Cool Planet Campus Carbon Calculator was an easy choice. There are several reasons why:

1. The Clean Air-Cool Planet Carbon Calculator (2006b) is presently used at over 200 schools throughout North America. Therefore, it has not only become a

reputable tool but is also the standard for calculating emissions. Furthermore, because the Clean Air-Cool Planet Carbon Calculator is so widely used it allows institutions to learn from one another as they complete their inventories.

2. The American College and University Presidents Climate Commitment specifically recommends the use of the Clean Air-Cool Planet Carbon Calculator. Obviously, it would be wise to use this tool since Evergreen President Les Purce is on the Leadership Circle of that commitment.
3. Incorporates reporting standards established jointly by the World Business Council for Sustainable Development and the World Resource Institute. This avoids "double counting" emissions and prioritizes the institutions accountability for the source of its emissions.
4. Because the Clean Air-Cool Planet Carbon Calculator has become so widely used institutions can be confident that this tool will not disappear anytime soon and will likely be updated and improved over time. At the time of my thesis, for example, Clean Air-Cool Planet had already released version 5.0. This is important for institutions like Evergreen with a long-term commitment to global warming where a carbon inventory should be completed on an annual or biannual basis.
5. As we learned in Chapter 1, CO_2 may be the most important of the greenhouse gases but it is not the only one. The Clean Air-Cool Planet Carbon Calculator (despite the specific reference to "carbon" in its title) includes the calculation of the other greenhouse gases (CH_4, N_2O, HFC, PFC, and SF_4) specified in the Kyoto Protocol (Clean-Air Cool-Planet, 2006b). This is important for Evergreen because we want to complete a full assessment of our contribution to global warming (not only our carbon emissions).
6. The Clean Air-Cool Planet Carbon Calculator is relatively easy to use. Calculating an institutions carbon budget involves complex formulas, conversion factors, global warming potentials, and subjective decision-making on what should or should not be included. Fortunately, the Clean Air-Cool Planet Carbon Calculator (which is a Microsoft Excel spreadsheet) has these formulas built-in and they follow Intergovernmental Panel on Climate Change protocol based on the latest science. Therefore, once the data is collected and entered, most of the calculations can be performed automatically.

7. The developers of the Clean Air-Cool Planet Carbon Calculator created a users guide to help facilitate data collection and analysis. The guide helps to standardize the methodology and permits different institutions to compare the work of other institutions. Moreover, a standardized protocol is important at the college and university level where a high rate of turnover means that different individual students or faculty members are likely to repeat the calculations. Ultimately, this eliminates some of the subjective decision-making regarding what should or should not be included in the inventory.
8. If there is unavailable emissions data, the Clean Air-Cool Planet Carbon Calculator allows the user to carry-on with the inventory and allows analyses with the information that is available.
9. The Clean Air-Cool Planet Carbon Calculator facilitates analyzing and summarizing the results by automatically producing charts and graphs once the data is entered.
10. The Clean Air-Cool Planet Carbon Calculator is designed to be used on an annual basis permitting institutions to track their emission trends over time.

Overall, the Clean Air-Cool Planet Carbon Calculator is the most reputable, comprehensive, and widely used campus carbon calculator in the country. For these reasons, I have decided to use it as the primary tool to complete Evergreen's emissions inventory. When possible I followed their protocol. With this being said, a significant challenge with completing Evergreen's carbon inventory is the numerous judgment calls and decisions that must be made. For example, whether or not to include certain activities in the inventory such as emissions from the application of lawn fertilizer, transportation miles from food distribution centers, or student out-of-state travel during vacations, just to name a few. Other decisions concerned what to do with partial data sets, lack of data, and choosing between various methods of estimation. Therefore, understanding the decision-making process and details behind the numbers are important and will be a major focus in the remainder of this chapter.

CHAPTER 6

The Data Acquisition Process

Prior to using the Clean Air-Cool Planet Campus Carbon Calculator I highly recommend reading the latest version of their *User's Guide*. The *User's Guide* can be downloaded from the Clean Air-Cool Planet website (www.cleanair-coolplanet.org). This document provides a general overview of the data acquisition process.

It is important to note that the most time consuming part in the entire process of completing Evergreen's carbon inventory was acquiring the necessary data. Therefore, allow at least one month for the data acquisition process. To provide a frame of reference, I began the process of collecting Evergreen's inventory data in early February 2007. By the second week of April, I still had not received some transportation and refrigerant data. However, because I was asking Evergreen staff for this data for the first time, it took longer than I expect it to in the future. I made a considerable effort to explain to the various departments and personnel what the purpose of the study was, why I was doing it, and informing them that this data will be asked for again on a regular basis in the future. Therefore, I expect that this will help speed the process for future inventories. Regardless, because of busy schedules and data that are not easily available, Evergreen staff members will need time to meet your request. Furthermore, you must anticipate that you may have to make multiple requests for the same data. Be courteous but persistent in explaining the importance of these data. Explain that you will be using the data they provide to help meet an important strategic goal of the college.

Officially, I began the data acquisition process on February 1, 2007. On that date, I met with Paul Smith (director of facilities), Rich Davis (college engineer), and Azeem Hoosein (assistant director for planning and construction). I provided an overview of Evergreen's climate policy of carbon neutrality and why it is an important strategic goal of the college. Then, I informed them that completing a carbon inventory was a critical step in the process and how it will provide Evergreen with important information necessary for future decision-making. Because Rich Davis is a member of the Sustainability Task Force, he is already familiar with this goal and the process that led to it. This, of course, helped facilitate the meeting. I then projected the Carbon Calculator (via digital projector) and walked them through the spreadsheet.

For reasons of consistency, I followed the protocol of the Clean Air-Cool Planet Campus Carbon Calculator. Their calculator is divided into the following broad data collection categories:

- Institutional Data
- Energy
- Transportation
- Agriculture
- Solid Waste
- Refrigeration and other chemicals (PFC's, HFC's, SF6)
- Offsets

For each of these categories, the Clean Air-Cool Planet calculator specifies what data are needed (i.e. purchased electricity, natural gas consumption, air travel, etc.) and in what units (i.e. kWh, MMBtu's, miles traveled per year, etc.). As we went through the spreadsheet the facilities team helped me identify who within each department is likely to have the data I needed.

Following our meeting Rich Davis sent an email to all the individuals we identified informing them that I will soon be contacting them for specific data related to the college's sustainability and strategic planning goals. At this point I created a "Data Acquisition Journal" using Microsoft Excel. This allowed me to fully document all communications and dates of data requests and deliveries. The Journal was an invaluable resource as it allowed me to keep track of whom I contacted, when, what method (i.e. email, phone, personal conversation, meeting, etc.), and what the outcome was. Furthermore, with Excel's data sorting capabilities, I was able to reorganize the information by date, person, data category, etc. This allowed me to manage the data and was a great asset for organizational purposes. I would highly recommend that whoever undertakes Evergreen's next greenhouse gas inventory to create a similar data acquisition journal listing who you contacted, what department they are in, and what method of communication was successful. This will likely save you time and effort.

Starting on February 5, I began emailing the individuals identified during my meeting with the facilities staff. I made three general requests:

1. I specified that I would like to have the data by February 19;
2. I requested data for Evergreen's main Olympia campus, Tacoma campus, and Gray's Harbor program (if appropriate);

3. I asked for information dating back to 1990 (if possible).

In most cases, I followed-up this initial data request with other emails, phone calls, office visits, and small group meetings. Expectedly, I received some responses stating that two weeks was not enough time to meet my request. In these cases I negotiated as to how much time was needed and we agreed on a future date. Additionally, I learned early on that I would need to focus on the Evergreen campus. I included data for the Tacoma and Gray's Harbor programs when possible, but at this time little of this data was available. Finally, I received relatively little data prior to 2004. Either records have not been kept or were not easily accessible. The main problem occurred because of Evergreen's recent transition to the Banner system. Because of this seemingly accessible data was difficult to acquire without significant effort. For example, detailed institutional budget data was not easily accessible prior to 2004. With this being said, I had a really strong and reliable data set between the years 2004-2006 for Evergreen's main Olympia campus.

CHAPTER 7

The Step-by-Step Process in Completing Evergreen's Carbon Inventory:

Inventory Data, Calculations and Results

In order to track The Evergreen State College's progression towards carbon neutrality, Evergreen's greenhouse gas inventory will need to be completed on a regular basis. Because this procedure requires numerous data acquisitions, calculations, and frequent judgment calls, it is important to provide the reader with the rationale and step-by-step process for how Evergreen's carbon inventory was calculated.

The Clean Air-Cool Planet Campus Carbon Calculator (2006b) follows the emissions reporting protocol established by the Intergovernmental Panel on Climate Change, the World Business Council for Sustainable Development, and the World Resources Institute. The result of this is accounting principles and formulas that require specific units of measure. These units must be entered into the Clean Air-Cool Planet Carbon Calculator. However, the data I acquired from Evergreen and the data required by the calculator were often different. There are a few reasons why. First, sometimes Evergreen recorded their data in different units of measurement. For example, pounds instead of gallons. This form of inconsistency was the easiest to rectify. Second, Evergreen had only partial or incomplete data, in some cases. For example, only the last six months of air travel data was available for Fiscal Year 2005. Third, some data required by the calculator forces judgment calls or estimates from Evergreen's available data because of incomplete knowledge. For example, determining the productivity and therefore the metric tonnes of CO_2 offset by Evergreen's forest. Fourth, some data required by the calculator is not measured at Evergreen. For example, the Carbon Calculator asks for student commuter miles per year. However, obtaining this data is very difficult forcing estimations by extrapolating existing institutional data. Fifth, in some cases I decided to include data and certain activities not specified by Clean Air-Cool Planet's Campus Carbon Calculator. For example, I decided to include Evergreen's application of lawn fertilizer on campus grounds and the greenhouse gas emissions released in delivering food from our vendor's distribution centers to campus.

For each of these reasons, the inventory (at one level or another) is subjective. I was forced to make estimates and utilize available data in a manner that required my best judgment. Because of this it is important to highlight the rationale I used in the methodology. I will do this by breaking down each general category of the inventory independently.

~ *Institutional Data* ~

Tracking institutional data is useful because it establishes a frame of historical reference. Obviously, significant changes in budget allocations, population or physical size can have a great influence over college activities and energy consumption and therefore greenhouse gas emissions. Therefore, institutional data should be recorded every year that an inventory is completed. Table 3 provides an overview of Evergreen's institutional data for Fiscal Years 2004–06.

Table 3*. Evergreen's Institutional Data for Fiscal Years 2004-06.*

Fiscal Year	Budget (dollars)		Population				Physical Size (sq ft)
	Operating Budget	Energy Budget	Full-Time Students	Part-Time Students	Faculty	Staff	Total Building Space
2004	$95,619,333.16	$1,499,980.95	3,872	538	224	495	1,618,039
2005	$90,384,806.57	$2,220,036.43	3,954	516	221	505	1,618,039
2006	$101,672,907.22	$2,410,483.48	3,909	507	232	502	1,618,039

Budget

- Data Requested: Total operating budget, research dollars, and energy budget from 1990 to 2006.
- Data Received: Operating budget and energy budget data from 2004-06.
- Data Received by: Accounting manager (Clifford Frederickson, CPA) and Executive Director of Operational Planning and Budget (Steve Trotter).
- Comments: Budget data prior to 2004 was unavailable within the specified period of time because of Evergreen's transition to the Banner system. Research dollars is not applicable because Evergreen does very little sponsored research. Finally, Pell awards were subtracted from the operating budget because this money simply moves through the system. Evergreen does not have financial control of these dollars and they are not used to operate the college.

Population

- Data Requested: Total number of full-time students, part-time students, faculty, and staff.
- Data Received: 1992-2006 full-time and part-time student enrollment; Operating budget and energy budget data from 2004-06.
- Data Received by: Office of Institutional Research and Assessment. This data is available on the Evergreen website at: http://www.evergreen.edu/institutionalresearch/factpage.htm

Physical Size

- Data Requested: Total building space and total research building space in square feet for Evergreen's Olympia and Tacoma campuses.
- Data Received: Total building space for Olympia and Tacoma campuses in square feet.
- Data Received by: Facilities College Engineer (Rich Davis).
- Comments: Evergreen does have research space within the Lab buildings; however, this is included in the total building space. Furthermore, Evergreen does not have buildings designated solely for research. Therefore, it was not necessary to account for total research building space required by the Carbon Calculator. The total building space number includes the campus core, shops, student housing, organic farm, and Tacoma campus. Construction of the Seminar II building was completed by 2004 and is therefore included in the total building space for 2004.

~ Energy ~

Energy use is fundamental to any carbon inventory. Generally speaking, emissions from either purchased electricity or on-campus stationary sources of energy are responsible for the vast majority of a campus's overall emissions. Therefore, tracking Evergreen's energy use over time is critical.

Purchased Electricity

Table 4 reveals the amount of greenhouse gases emitted from Evergreen's use of purchased electricity from Puget Sound Energy and Tacoma Power and Light between Fiscal Years 2004 and 2006. For each year the total amount of energy used, and therefore greenhouse gases emitted, increased.

Table 4. *Evergreen's Greenhouse Gas Emissions from Purchased Electricity, Fiscal Years 2004-06.*

Fiscal Year	Purchased Electricity (kWh)	Emission Coefficients	Evergreen's Emissions (MTCDE)
2004	15,299,000	0.00054 MTCDE/kWh	**8,298**
2005	16,066,000	0.00054 MTCDE/kWh	**8,740**
2006	16,459,000	0.00054 MTCDE/kWh	**8,954**

- Data Requested: Kilowatt-hours of purchased electricity from Puget Sound Energy for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: Megawatt-hours of purchased electricity from 2002-06 for Evergreen's main campus.
- Data Received by: Facilities College Engineer (Rich Davis).
- Comments: Multiplying megawatt-hours by 1000 converts the data to kilowatt-hours. When purchasing data from a provider one has the option of entering the standard fuel mix for the region or one can get more specific and enter a custom fuel mix. I contacted Puget Sound Energy to receive their power supply profile and entered this data. In 2005, Puget Sound Energy's fuel mix was: hydroelectric (42.10%), coal (36.35%), natural gas (18.92%), nuclear (1.12%), wind[12] (0.15%), and

[12] Wind power was expected to increase to 5% of Puget Sound Energy's power supply by the end of 2006 but this was not confirmed at the time of this writing.

other (1.36%). The "other" category included petroleum, waste to energy, and biomass. Since I did not have specific values for each I simply divided 1.36% by three and entered 0.45% for each category. Finally, Evergreen does not purchase steam or chilled water so there was no data to enter for these categories.

On-Campus Stationary Sources of Energy

Evergreen purchases natural gas and distillate oil #2 from Puget Sound Energy to produce steam in order to provide heat to the buildings. When Puget Sound Energy experiences high demand for natural gas they inform Evergreen and we purchase distillate oil until regional demand decreases. This is a contractual agreement between Puget Sound Energy and Evergreen. Evergreen does not co-generate electricity and therefore has no data to enter in the calculator.

Evergreen burns propane fuel to power a forklift, lab equipment, and for the fireplace in the Longhouse. Evergreen's combined use of natural gas, distillate oil #2, and propane fuel comprises Evergreen's on-campus stationary sources of energy that emit greenhouse gases (Table 5).

Natural Gas:

- Data Requested: MMBtu's of natural gas for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: I received natural gas in therms from 2002-06 for Evergreen's main campus.
- Data Received by: Facilities College Engineer (Rich Davis).
- Comments: I had to convert from therms to MMBtu's. 1 therm = 100,000 Btu's and 1,000,000 Btu's = 1 MMBtu's. Or, 10 therms = 1 MMBtu. Therefore, all I had to do was divide the total number of therms by 10 in order to convert Evergreen's data into MMBtu.

Table 5. *Evergreen's Greenhouse Gas Emissions from On-Campus Stationary Sources, FY 2004-06.*

Fiscal Year 2004		**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Space Heating & Hot Water	Natural Gas	109,605 MMBtu	0.05300 MTCDE/MMBtu	**5,809**
	Distillate Oil #2	3,542 Gallons	0.01000 MTCDE/gallon	**35**
Forklift, Labs, Longhouse	Propane Use	250 Gallons	0.00500 MTCDE/gallon	**1**
				Total Emissions = 5,845
Fiscal Year 2005		**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Space Heating & Hot Water	Natural Gas	107,237 MMBtu	0.05300 MTCDE/MMBtu	**5,683**
	Distillate Oil #2	3,542 Gallons	0.01000 MTCDE/gallon	**35**
Forklift, Labs, Longhouse	Propane Use	250 Gallons	0.00500 MTCDE/gallon	**1**
				Total Emissions = 5,719
Fiscal Year 2006		**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Space Heating & Hot Water	Natural Gas	115,753 MMBtu	0.05300 MTCDE/MMBtu	**6,135**
	Distillate Oil #2	3,542 Gallons	0.01000 MTCDE/gallon	**35**
Forklift, Labs, Longhouse	Propane Use	250 Gallons	0.00500 MTCDE/gallon	**1**
				Total Emissions = 6,171

Distillate Oil #2:

- Data Requested: Gallons of distillate oil #2 for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: 3,542 gallons of distillate oil #2 for 2006.
- Data Received by: Facilities Utility Services Specialist (Ed Rivera); Facilities Maintenance Mechanic (Patty Van de Walker); Introduction to Environmental Studies Program (Student Project – *Why we should care, why we must act: TESC Carbon Budget, Preliminary Report*, March 2007), instructed by Rob Cole and Dylan Fischer.[13]
- Comments: After several requests by email and during two guided tours of Evergreen's Central Utility Plant I had not received gallons of distillate oil used per year. But, I was told on several occasions that Evergreen's use of distillate oil is low (averaging about two weeks per). When in use, Evergreen burns about 253 gallons per day of oil. This information was stated by the facilities staff and corroborated in the Introduction to Environmental Studies student report. Therefore, I estimated that Evergreen uses about 3,542 gallons of distillate oil #2 per year (14 days per year multiplied by 253 gallons per day).

Propane:

- Data Requested: Gallons of propane for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: 250 gallons per year.
- Data Received by: Facilities Maintenance Services (Sherry Parsons).

[13] A copy of this report can be requested by contacting Evergreen faculty member Rob Cole.

- Comments: Evergreen uses propane for a forklift, laboratory work in the Lab buildings, and for a fireplace in the Longhouse. Sherry informed me that Evergreen had previously used a 250-gallon propane tank that was filled on average less than once per year. In the fall of 2006, facilities removed the tank and are now using three cylinders that they take into town to have refilled. Since no specific records are kept I gave a high estimate of 250-gallons of propane used per year.

~ Transportation ~

College Fleet

Evergreen, like most colleges and universities, owns and maintains a fleet of vehicles. The decisions Evergreen makes regarding the purchase and operation of this fleet has a direct impact on our institutions greenhouse gas emissions. Therefore, it is important to keep track of Evergreen's fleet fuel use, as it is a direct contribution to global warming. Evergreen does maintain an electric fleet used by facilities personnel. However, charging these vehicles is not recorded in the transportation sector because the electricity used to recharge them is recorded under purchased electricity from Puget Sound Energy. Table 6 shows Evergreen's greenhouse gas

***Table 6**. Evergreen's Greenhouse Gas Emissions from College Fleet Vehicles, FY 2004-06.*

Fiscal Year 2004			
Fuel	**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Gasoline	25,111 gallons	0.009 MTCDE/gallon	**226**
Diesel	5,504 gallons	0.010 MTCDE/gallon	**55**
			Total Emissions = 281
Fiscal Year 2005			
Fuel	**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Gasoline	23,782 gallons	0.009 MTCDE/gallon	**214**
Diesel	5,768 gallons	0.010 MTCDE/gallon	**58**
			Total Emissions = 272
Fiscal Year 2006			
Fuel	**Consumption**	**Emission Coefficients**	**Evergreen's Emissions (MTCDE)**
Gasoline	25,550 gallons	0.009 MTCDE/gallon	**230**
Diesel	6,240 gallons	0.010 MTCDE/gallon	**62**
			Total Emissions = 292

emissions from the college fleet for Fiscal Years 2004-06.

Gasoline Fleet:

- Data Requested: Total gallons of gasoline purchased for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: Total gallons of gasoline purchased from 2004-06 for Evergreen's main campus fleet.
- Data Received by: Facilities Maintenance Services (Sherry Parsons).
- Comments: Facilities keeps records for fuel consumption at Evergreen's motor pool garage gas pump. However, this does not include information for vehicles fueled off campus. For this information, Sherry had receipts recording the total dollar amount. By knowing the total amount of money spent on gasoline for the off-campus vehicle fleet, Sherry estimated the total gallons used based on the average cost of fuel. However, data for off-campus gasoline use was unavailable for the year 2004. Because of this I averaged the 2005 and 2006 data in order to estimate 2004 off-campus fleet fuel consumption. Based on this estimation, Evergreen's 2004 total fleet gasoline consumption was 25,111 gallons. In 2005, it was 23,782 gallons. And, in 2006, it was 25,550 gallons.

Diesel Fleet:

- Data Requested: Total gallons of diesel fuel purchased for Evergreen's Olympia, Tacoma, and Gray's Harbor programs from 1990 to 2006.
- Data Received: Total gallons of diesel purchased from 2004-06 for Evergreen's main campus fleet.
- Data Received by: Facilities Maintenance Services (Sherry Parsons).
- Comments: Again, similar to the data for gasoline use, gallons of diesel use were available from the motor pool and from an estimation of receipts. Once again, data for off-campus diesel use was unavailable for the year 2004 so I averaged the 2005 and 2006 data. Based on this estimation, Evergreen's 2004 fleet diesel fuel consumption was 5,504 gallons. In 2005, it was 5,768 gallons. And, in 2006, it was 6,240 gallons.

Food Delivery

There are many factors that ultimately decide what food Evergreen purchases and from whom. One of these factors should be the amount of greenhouse gases emitted as a result of the distance that Evergreen's food needs to travel to get to campus. In Fiscal Year 2006, the total distance traveled to bring food to Evergreen's main Olympia campus from our supplier's food distribution centers was 151,410 miles which emitted 126 metric tonnes of carbon dioxide equivalent (Table 7). See Appendix A for the complete list of vendors and the distance and frequency they traveled to campus. This data was unavailable for Fiscal Years 2004 and 2005.

***Table** 7. Evergreen's Greenhouse Gas Emissions from Food Delivery for FY 2006.*

Total Roundtrip Distance	Estimated Average Fuel Economy	Diesel Fuel	Emissions Coefficient	Evergreen's Emissions (MTCDE)
151,410 miles	12 mpg	12,618 gallons	0.01 MTCDE/gallon	**126**

Details Behind the Data:

- Data Requested: Total gallons of diesel fuel used to deliver food to the Evergreen campus in 2006 from our suppliers distribution centers.
- Data Received: Total roundtrip miles traveled from Evergreen's food suppliers (distribution centers) to camps for 2006.
- Data Received by: Director of Food Services for Aramark (Craig Ward).
- Comments: Ultimately, I had to make a rough estimate as to the average fuel economy and type of fuel use because I did not have information on what type of vehicles are used for food deliveries. I decided on 12 miles per gallon of diesel fuel as an estimated average.

Air Travel

- Data Requested: Faculty, staff, and student air miles traveled per year. This includes air travel for conferences, educational programs, awards, business trips, athletics, etc. that the institutional pays for. It does not include any personal travel. For example, student travel to and from home during breaks.

- Data Received: I received information on the airport of origin and destination city for each trip paid for by Evergreen. I received 5 months of information for 2005 and the complete year for 2006.
- Data Received by: Air Travel Department (Jennifer Dumpert).
- Comments: I had to calculate the number of miles between airport of origin and destination. I used Google Earth ruler to measure the distance between cities and corroborated this with an online airport calculator that is available online at: http://www.world-airport-codes.com. Once I determined the number of miles between airports I summed up the total for the year. For 2005, I only had data for five months (February – June). So, I determined the average air miles traveled per month and extended this for the other seven months to get an estimation for the year. The number of annual air miles I entered for 2006 is a low estimate because the air travel department did not have data for the number of flights that were originally purchased by Evergreen community members then reimbursed by the college. Though the Air Travel Department stated that reimbursement for air travel was uncommon. Table 8 shows the number of air miles traveled and the greenhouse gas emissions associated with it.

Table 8. *Evergreen's Greenhouse Gas Emissions from Air Travel for FY 2005-06.*

Fiscal Year	Total Distance	Emissions Coefficient	Evergreen's Emissions (MTCDE)
2005	1,819,099 miles	0.00078 MTCDE/mile	**1,419**
2006	1,380,178 miles	0.00078 MTCDE/mile	**1,077**

Commuters

Evergreen is located several miles from the nearest urban area (Olympia) and does not provide enough living accommodations for all of its community members. As a result, many faculty, staff, and students either choose or are forced to commute several miles to get to work or to attend classes at Evergreen. Transportation to and from campus can be a significant contribution to Evergreen's overall greenhouse emissions. Ultimately, the approximate number of gallons of gasoline and diesel fuel used per year is needed to determine overall emissions from commuter habits.

Unfortunately, this data is difficult to come by. Parking Services does a thorough job of conducting daily parking lot counts. This information tells how many cars are in the parking lot at any one time, but fails to account for how far they have driven to get to campus, whether the driver has come alone or part of a carpool, and what the turnover is. In other words, in all likelihood many community members commute to Evergreen and stay for part of the day and are replaced by other commuters. Parking lot counts do not track different vehicles coming and going into the parking area (only the number of open parking spaces).

Parking Services also conducts “random moment counts.” One day per quarter, staff will count the number of vehicles and the number of passengers within each vehicle driving into Evergreen’s main entrance (McCann Plaza). However, this method also has several limitations when determining the number of commuter miles per year. First, the counts where done on the same day each quarter (Thursday). This can be problematic because some days of the week are very busy while others are relatively quiet. Counting the same day every quarter may lead to results that are far above or far below the average. Second, the counts started at 8:30am which means that a fair number of commuters are likely missed from 7:00-8:30am. Third, commuters parking at the Dorm Loop or any of Evergreen’s other entrances are not counted in the survey. Fourth, counts do not reveal whether the commuters are students coming to campus three times per week or staff arriving everyday. Fifth, random counts do not reveal how far the commuter has traveled. Additionally, I did not have random count data for 2006. For these reasons, I decided not to use the data from either the daily parking lot counts or the random moment counts.

So, how did I estimate the average number of gallons used per year? Four questions need to be answered:

1) How many commuters are there and how do they get to campus (i.e. drive personal vehicle alone, carpool, public transportation, etc.)?
2) How far do they travel?
3) How many times per week do they commute?
4) What is the fuel efficiency of the vehicle(s) they use to get to campus?

Fortunately, the answers for each of these questions can be estimated using existing institutional data.

Faculty/Staff Gasoline:

The first step is to estimate the number of gallons of gasoline used by faculty and staff on an annual basis to get back and forth to work. Estimating this was possible from data contained in Evergreen's 2005 Commute Trip Reduction Survey Report. This report is available through the Parking Supervisor (Susie Seip) in Parking Services. The easiest way to break this down is to look at each of the above questions in turn.

1) How many commuters are there and how do they get to campus (i.e. drive personal vehicle alone, carpool, public transportation, etc.)?
   According to the 2005 Commute Trip Reduction Survey, 71% of Evergreen employees drive alone to work and 24% carpool.
2) How far do they travel?
   The average home to work distance was 13.3 miles or 26.6 miles roundtrip.
3) How many times per week do they commute and how many weeks per year do they work?
   Employees who drive alone do so 4.1 times per week. Those who carpool do so three times per week. The average Evergreen employee works 48 weeks per year. Evergreen's payroll manager (Ladronna Herigstad) informed me that staff members have 10 days off per year for holidays and receive a minimum of four days of leave per year. So, the average staff member works 50 weeks per year with 2 weeks of vacation/holiday time. Additionally, I estimated that faculty members work on average 44 weeks per year (there are 4 quarters with 11 weeks per quarter). Because there is more than twice as many staff as faculty the weighted average comes out to be 48 weeks per year for the average Evergreen employee.
4) What is the fuel efficiency of the vehicle(s) they use to get to campus?
   Students working in the Parking Office who were also enrolled in the 2007 Introduction to Environmental Studies program estimated that vehicles registered through parking services average 24.3 miles per gallon.

With all of the necessary information in place, it is now possible to estimate the metric tonnes of carbon dioxide equivalent emitted annually by Evergreen employees commuting back and forth to work.

Calculations:

Employees who drive alone:

Step 1: Determine total annual miles traveled:

(Total # employees) x (% that drive alone) x (# of trips per week) x (roundtrip distance) x (# weeks per year) = total annual miles traveled.

Step 2: Determine total gallons of fuel used per year:

(Total annual miles traveled) / (average miles per gallon of Evergreen fleet) = gallons of gasoline used annually.

Step 3: Determine the metric tonnes of carbon dioxide equivalent:

(Gallons of gasoline used annually) x (gasoline's emissions factor) = total amount of metric tonnes of carbon dioxide equivalent emitted annually from Evergreen employees who drive alone to work.

Employees who carpool:

Step 1: Determine total annual miles traveled:

(Total # employees) x (% that carpool) x (# of trips per week) x (roundtrip distance) x (# weeks per year) = total annual miles traveled.

Step 2: Determine total gallons of fuel used per year:

(Total annual miles traveled) / (average miles per gallon of Evergreen fleet) = gallons of gasoline used annually.

Step 3: Determine the metric tonnes of carbon dioxide equivalent:

(Gallons of gasoline used annually) x (gasoline's emissions factor) = total amount of metric tonnes of carbon dioxide equivalent emitted annually from Evergreen employees who carpool to work.

See Table 9 for an overview of Evergreen employee commuter habits.

Student Gasoline:

Determining an estimate for the number of gallons of gasoline used by student commuters follows the same methodology for employees. However, since the Commute Trip Reduction Survey only questions employees, I had to find another source for the information. This came from the Evergreen Student Experience Survey 2006 conducted by the Office of Institutional Research and Assessment.

Table 9*. Employee Commuter Habits that Contribute to Evergreen's Overall Greenhouse Gas Emissions.*

Employees that Drive Alone: Single Occupancy Vehicle (SOV)

Year	Employees that Drive Alone	Trips Per Week	Roundtrip Miles	Weeks Per Year	Annual Miles Traveled	Average Miles Per Gallon	Gallons Per Year	Gasoline Emissions Coefficient	**Total MTCDE**
2004	510	4.1	26.6	48	2,672,354	24.3	109,973	0.009	**990**
2005	515	4.1	26.6	48	2,698,371	24.3	111,044	0.009	**999**
2006	521	4.1	26.6	48	2,728,105	24.3	112,268	0.009	**1,010**

Employees that Car Pool: Estimated Average is 2.5 Passengers Per Vehicle

Year	Employees that Carpool	Trips Per Week	Roundtrip Miles	Weeks Per Year	Annual Miles Traveled Per Commuter	Average Miles Per Gallon	Gallons Per Year Per Person	Gasoline Emissions Coefficient	**Total MTCDE**
2004	173	3	26.6	48	264,390	24.3	10,880	0.009	**245**
2005	174	3	26.6	48	266,964	24.3	10,986	0.009	**247**
2006	176	3	26.6	48	269,905	24.3	11,107	0.009	**250**

Let's once again answer each of the necessary questions:

1) How many commuters are there and how do they get to campus (i.e. drive personal vehicle alone, carpool, etc.)?

According to the 2006 Student Experience Survey, 56.3% of Evergreen students drive alone to work and 17.7% carpool.

2) How far do they travel?

The average home to campus distance was 13.3 miles or 26.6 miles roundtrip.

3) How many times per week do they commute and how many weeks per year do they work?

Students who drive alone do so 2.9 times per week; those who carpool do so 2.1 times per week; and those who take the bus do so 3.1 times per week. The average Evergreen student commutes to campus 44 weeks per year. This, of course, is an estimate. I figured four quarters per year with 11 weeks per quarter.

4) What is the fuel efficiency of the vehicle(s) they use to get to campus?

Once again, I obtained this information from the research done by the students working in the Parking Office (who were also enrolled in the 2007 Introduction to Environmental Studies program). They estimated that vehicles registered through parking services average 24.3 miles per gallon.

Once again, with all of the necessary information, it is now possible to estimate the metric tonnes of carbon dioxide equivalent emitted annually by Evergreen students commuting back and forth to classes.

Calculations:

Students who drive alone:

Step 1: Determine total annual miles traveled:

(Total # students) x (% that drive alone) x (# of trips per week) x (roundtrip distance) x (# weeks per year) = total annual miles traveled.

Step 2: Determine total gallons of fuel used per year:

(Total annual miles traveled) / (average miles per gallon of Evergreen fleet) = gallons of gasoline used annually.

Step 3: Determine the metric tonnes of carbon dioxide equivalent:

(Gallons of gasoline used annually) x (gasoline's emissions factor) = total amount of metric tonnes of carbon dioxide equivalent emitted annually from Evergreen students who drive alone to work.

Students who carpool:

Step 1: Determine total annual miles traveled:

(Total # students) x (% that carpool) x (# of trips per week) x (roundtrip distance) x (# weeks per year) = total annual miles traveled.

Step 2: Determine total gallons of fuel used per year:

(Total annual miles traveled) / (average miles per gallon of Evergreen fleet) = gallons of gasoline used annually.

Step 3: Determine the metric tonnes of carbon dioxide equivalent:

(Gallons of gasoline used annually) x (gasoline's emissions factor) = total amount of metric tonnes of carbon dioxide equivalent emitted annually from Evergreen students who carpool to campus.

See Table 10 for an overview of student commuter habits.

***Table 10**. Student Commuter Habits that Contribute to Evergreen's Overall Greenhouse Gas Emissions.*

Students that Drive Alone: Single Occupancy Vehicle (SOV)

Year	Students that Drive Alone	Trips Per Week	Roundtrip Miles	Weeks Per Year	Annual Miles Traveled	Average Miles Per Gallon	Gallons Per Year	Gasoline Emissions Factor	**Total MTCDE**
2004	2,331	2.9	26.6	44	7,913,087	24.3	325,641	0.009	**2,931**
2005	2,371	2.9	26.6	44	8,048,762	24.3	331,225	0.009	**2,981**
2006	2,344	2.9	26.6	44	7,955,127	24.3	327,371	0.009	**2,946**

Students that Car Pool: Estimated Average is 2.5 Passengers Per Vehicle

Year	Students that Carpool	Trips Per Week	Roundtrip Miles	Weeks Per Year	Annual Miles Traveled Per Commuter	Average Miles Per Gallon	Gallons Per Year Per Person	Gasoline Emissions Factor	**Total MTCDE**
2004	733	2.1	26.6	44	720,596	24.3	29,654	0.009	**667**
2005	746	2.1	26.6	44	732,951	24.3	30,163	0.009	**679**
2006	737	2.1	26.6	44	724,425	24.3	29,812	0.009	**671**

Public Transportation – Intercity Transit (Bus):

Public transportation is also available to the Evergreen community. Intercity Transit provides two bus routes to the Evergreen campus: routes 41 and 48. These buses run regardless of how many community members take advantage of the transportation. Therefore, in order to determine total emissions, it is necessary to calculate the total metric tonnes of carbon dioxide equivalent emitted by the two buses that service Evergreen without factoring in the number of riders. With this being said, there is an obvious advantage to increasing ridership on the bus. For example, the bus will emit the same amount of metric tonnes of carbon dioxide equivalent whether one person takes the bus or forty.

Determining an estimate for the number of gallons of fuel used by the two buses servicing Evergreen one needs to ask:

1) What is the number of times per week each bus stops at Evergreen?
2) What is the distance from downtown to the campus?
3) What type of fuel is used and what are the average miles per gallon?

Again, I will answer each of these questions in turn:

1) What is the number of times per week each bus stops at Evergreen? Route 41 makes 216 trips to Evergreen per week and route 48 makes 135 trips

per week. This information came from the students working in Parking Services who also conducted Evergreen's carbon budget preliminary report.

2) What is the distance from downtown to the campus? Bus 41 makes a 13.4-mile loop from downtown to campus and bus 48 makes a 13-mile loop. This information also came from the students working in Parking Services who conducted Evergreen's carbon budget preliminary report.

3) What type of fuel is used and what are the average miles per gallon? The bus uses ultra low sulfur B20 diesel fuel and gets 4.7 miles per gallon. This information can be obtained from the Intercity Transit website at: http://www.intercitytransit.com/page.cfm?ID=0075. It is important to note that according to the EPA, B20 biodiesel emits the same level of greenhouse gases as regular diesel (EPA, 2002a). The advantage to biodiesel is of course that it is renewable.

Equipped with all of the necessary information, it is once again possible to estimate the metric tonnes of carbon dioxide equivalent emitted annually by the two bus routes that service the Evergreen campus.

Community members who use public transportation (bus):

Step 1: Determine total annual miles traveled:

(Total trips per week) x (miles per trip) x (# weeks per year) = total annual miles traveled.

Step 2: Determine total gallons of fuel used per year:

(Total annual miles traveled) / (average miles per gallon of buses 41 and 48) = gallons of gasoline used annually.

Step 3: Determine the metric tonnes of carbon dioxide equivalent:

(Gallons of gasoline used annually) x (biodiesel (20% biodiesel; 80% diesel mix) emissions factor) = total amount of metric tonnes of carbon dioxide equivalent emitted annually from the two buses that service the Evergreen Campus.

See Table 11 for an overview of Intercity Transit emissions in metric tonnes of carbon dioxide equivalent.

Table 11. *Public Transportation (Bus): Employee and Student Use.*

Intercity Transit: The Bus uses B20 Ultra Low Sulfur Diesel

Year	Total Trips Per Week	Total Miles Per Week	Weeks Per Year	Annual Miles Traveled	Average Miles Per Gallon	Gallons Per Year	Biodiesel Emissions Factor	**Total MTCDE**
2004	351	4,649	52	241,769	4.7	51,440	0.01	**514**
2005	351	4,649	52	241,769	4.7	51,440	0.01	**514**
2006	351	4,649	52	241,769	4.7	51,440	0.01	**514**

Year	% that Bus	Employees that take the Bus	% that Bus	Students that take the Bus	Evergreen Commuters that take the Bus	Total MTCDE	MTCDE Per Evergreen Commuter	**Pounds Per Person Per Year**
2004	6	43	29	1,180	1,223	514	0.42	**924**
2005	6	44	29	1,200	1,244	514	0.41	**902**
2006	6	44	29	1,186	1,230	514	0.42	**924**

Finally, by adding the sums together (the values of step 3 above from each section) we can get the grand total metric tonnes of carbon dioxide equivalent emissions from Evergreen's commuter habits for Fiscal Years 2004-06 (Table 12**)**.

Table 12. *Evergreen's Total Commuter Greenhouse Gas Emissions (MTCDE).*

	Single Occupancy Vehicles			Carpool			Intercity Transit	**TOTAL EMISSIONS (MTCDE)**
Year	Employees	Students	Total	Employees	Students	Total	Total	
2004	989.8	2930.8	3920.6	244.8	667.2	912.0	514.4	**5347.0**
2005	999.4	2981.0	3980.4	247.2	678.7	925.9	514.4	**5420.7**
2006	1010.4	2946.3	3956.7	249.9	670.8	920.7	514.4	**5391.8**

Table 13. *Comparison of Greenhouse Gases Emitted Per Person for Different Commuter Habits. Carpooling significantly reduces greenhouse gas emissions per commuter. Commuters who take the bus also have a much smaller greenhouse gas footprint than those who drive alone. As bus ridership continues to increase the emissions per person decreases.*

	Employees				**Students**				**Intercity Transit**	
	Drive Alone: SOV		Carpool		Drive Alone: SOV		Carpool		Bus	
Year	MTCDE Per Person Per Year	lbs Per Person Per Year	MTCDE Per Person Per Year	lbs Per Person Per Year	MTCDE Per Person Per Year	lbs Per Person Per Year	MTCDE Per Person Per Year	lbs Per Person Per Year	MTCDE Per Person Per Year	lbs Per Person Per Year
2004	1.94	4,265	0.57	1,248	1.26	2,766	0.36	801	0.42	924
2005	1.94	4,265	0.57	1,248	1.26	2,766	0.36	801	0.41	902
2006	1.94	4,265	0.57	1,248	1.26	2,766	0.36	801	0.42	924

However, it is also instructional to know the average emissions per person for each mode of commuting. For those who drive alone this is straightforward: take the total metric tonnes of carbon dioxide equivalent and divide it by the total number of commuters who drive alone to campus. For those who carpool, take the total metric tonnes of carbon dioxide equivalent, divide it by the total number of commuters who carpool, then divide it again by the average number of people in each carpool. I estimated 2.5 people per carpool for the Evergreen community. For those who take the bus to campus, take the total metric tonnes of carbon dioxide equivalent and divide it by the total number of commuters who take the bus. Obviously, the more community members that take the bus, the smaller the emissions are per person. Increasing bus ridership is, therefore, one possible way to reduce Evergreen's overall greenhouse gas footprint. Table 13 provides an overview of metric tonnes and pounds of carbon dioxide equivalent emitted per person for the different types of commuter habits. Carpooling and taking the bus significantly reduces the level of greenhouse gas emissions per commuter.

- Data Received: I received information on the airport of origin and destination city for each trip paid for by Evergreen. I received 5 months of information for 2005 and the complete year for 2006.
- Data Received by: Air Travel Department (Jennifer Dumpert).
- Comments: I had to calculate the number of miles between airport of origin and destination. I used Google Earth ruler to measure the distance between cities and corroborated this with an online airport calculator that is available online at: http://www.world-airport-codes.com. Once I determined the number of miles between airports I summed up the total for the year. For 2005, I only had data for five months (February – June). So, I determined the average air miles traveled per month and extended this for the other seven months to get an estimation for the year. The number of annual air miles I entered for 2006 is a low estimate because the air travel department did not have data for the number of flights that were originally purchased by Evergreen community members then reimbursed by the college. Though the Air Travel Department stated that reimbursement for air travel was uncommon. Table 8 shows the number of air miles traveled and the greenhouse gas emissions associated with it.

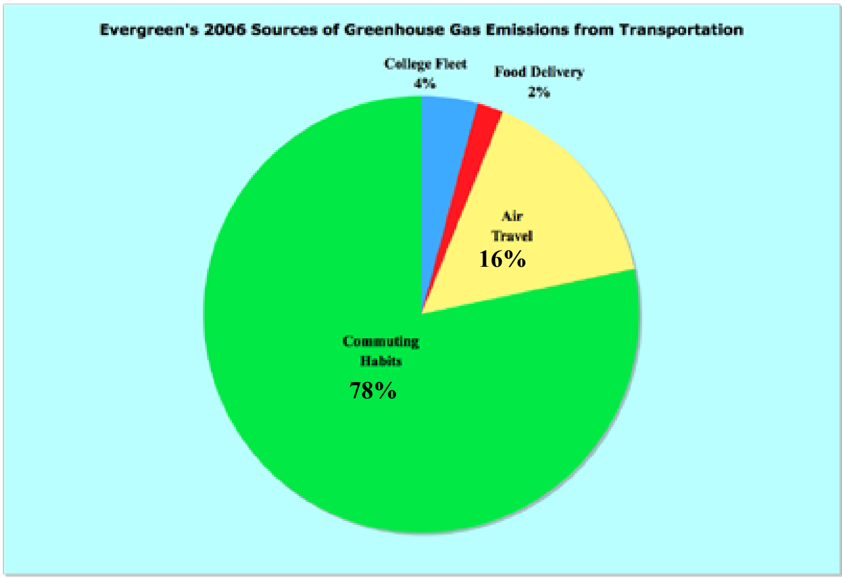
Table 8. *Evergreen's Greenhouse Gas Emissions from Air Travel for FY 2005-06.*

Fiscal Year	Total Distance	Emissions Coefficient	Evergreen's Emissions (MTCDE)
2005	1,819,099 miles	0.00078 MTCDE/mile	**1,419**
2006	1,380,178 miles	0.00078 MTCDE/mile	**1,077**

Commuters

Evergreen is located several miles from the nearest urban area (Olympia) and does not provide enough living accommodations for all of its community members. As a result, many faculty, staff, and students either choose or are forced to commute several miles to get to work or to attend classes at Evergreen. Transportation to and from campus can be a significant contribution to Evergreen's overall greenhouse emissions. Ultimately, the approximate number of gallons of gasoline and diesel fuel used per year is needed to determine overall emissions from commuter habits.

Figure 7. *Evergreen's 2006 Sources of Greenhouse Gas Emissions from Transportation. Commuting habits contribute the majority (78%) of Evergreen's transportation emissions.*



Year 2006. Commuting was responsible for over 78% of transportation emissions in 2006.

~ Fertilizer Application and Agricultural Practices ~

Any fertilizer used on campus that contains nitrogen will release nitrous oxides into the atmosphere and should be calculated in Evergreen's carbon inventory. Additionally, dairy animals from Evergreen's organic farm will also contribute methane to the atmosphere as they metabolize their food and as their waste decomposes (Clean-Air Cool-Planet, 2006b). Calculating emissions from fertilizer application and agricultural practices are a small percentage of Evergreen's overall emissions but they do contribute to global warming and are therefore worth tracking (Tables 15 and 16).

Fertilizer Application

- Data Requested: Pounds of synthetic and organic fertilizer used on campus per year and what percentage of nitrogen they contain.

***Table 15**. Evergreen's Greenhouse Gas Emissions from Fertilizer Application on College Grounds including the Organic Farm for FY 2004-06.*

Fiscal Year	Organic Fertilizer	% Nitrogen	Emissions Coefficient	Evergreen's Emissions (MTCDE)
2004	8,200 pounds	22%	0.0038 MTCDE/lb	**6.9**
2005	8,140 pounds	22%	0.0038 MTCDE/lb	**6.8**
2006	8,125 pounds	22%	0.0038 MTCDE/lb	**6.8**

- Data Received: from 2004-2006 Evergreen applied 8,000 lbs of Wilbur Ellis organic based fertilizer containing 22% nitrogen (22-2-12) on campus grounds. On the organic farm it varied between years:
  - 2004: 200 pounds of Biogrow with 7% nitrogen (7-7-2);
  - 2005: 100 pounds of feathermeal and 40 pounds of BioGrow with 7% nitrogen (7-7-2);
  - 2006: 100 pounds of canola meal with 6% nitrogen (6-2.5-1) and 25 pounds of kelp meal with 14% nitrogen.
- Data Received by: Facilities Grounds and Motor Pool Manager (Mark Kormondy) and Organic Farm Manager (Melissa Barker).
- Comments: Annually, at least 97.6% of the fertilizer used on campus contains 22% nitrogen. Since the Carbon Calculator asks for only one percentage, I decided to sum the total weight of all the fertilizer used at Evergreen at 22% nitrogen. For example, for 2006, I entered 8,125 pounds of fertilizer containing 22% nitrogen. This amounts to an insignificant overestimate of the total amount of nitrogen applied as fertilizer. Annually, less than eight metric tonnes of carbon dioxide equivalent are emitted from Evergreen's campus-wide use of organic fertilizer (Table 15).

***Table 16**. Evergreen's Greenhouse Gas Emissions from Animal Agriculture on the Organic Farm for FY 2004-06.*

Fiscal Year	# Swine (Pigs)	# Goats	# Poultry	Evergreen's Emissions (MTCDE)
2004	2	0	140	**1.4**
2005	0	0	145	**0.7**
2006	0	2	176	**1.1**

Animal Agriculture

- Data Requested: Average number of animals living on the Organic Farm from 2004-2006.

- Data Received:
    - 2004: 140 chickens and 2 pigs;
    - 2005: 130 chickens and 15 ducks;
    - 2006: 155 chickens, 12 ducks, 9 turkeys, and 2 goats.
- Data Received by: Organic Farm Manager (Melissa Barker).

~ Solid Waste ~

Solid waste includes mixed paper, co-mingle (glass and plastic), cardboard, aluminum, wood, ferrous metals, and garbage that ends up in a landfill. For the purposes of Evergreen's carbon inventory, I am only concerned about the amount of solid waste that ends up in a landfill (this does not include composted or recycled waste). Landfill waste will emit methane as it decomposes. However, different landfills have different techniques and methods for how it handles its solid waste and these different techniques result in different levels of greenhouse gas emissions. Therefore, it is important to know where Evergreen's waste ends up and how it is processed.

The facilities department trucks Evergreen's solid waste to the Hawk's Prairie Transfer Station in Lacey, WA. From Hawk's Prairie, it is trucked to Centralia, WA where it is loaded onto a train destined for Goldendale, WA. From Goldendale, Evergreen's landfill waste is trucked to the Roosevelt Landfill in Klickitat County, WA. The fuel used, and therefore greenhouse gas emissions, to transport Evergreen's solid waste from campus to the Hawk's Prairie Transfer Station is included in the College Fleet

Table 17*. Gallons of Diesel Fuel Per Year to Transport Landfilled Waste from Hawk's Prairie to Centralia, WA.*

Distance (Roundtrip): Hawk's Prairie – Centralia (miles)	64
Average Fuel Economy (mpg)	7
Diesel Fuel per Roundtrip (gallons)	9.1
Trucks Capacity (tons)	19.5
Annual Trips to Centralia	16
Gallons of Fuel per Year	**146**

data. However, the fuel used to bring Evergreen's waste from Hawk's Prairie to Centralia, WA is unaccounted for and ought to be included in the inventory. Approximately, 146 gallons of diesel fuel per year are used to transport Evergreen's landfilled waste to Centralia and this accounts for 1.5 metric tonnes of emissions (Tables 17 and 18).

I was unable to account for the amount of emissions to transport Evergreen's waste from Centralia to Goldendale via freight train on the Burlington Northern Santa Fe Railway (BNSF). To calculate this information one would need to know the fuel economy of the train, how many trips the train makes per year carrying Evergreen's solid waste, and what portion of the emissions Evergreen should be accountable for. Ultimately, this accounts for a very small percentage of Evergreen's overall emissions so I made a decision not to inquire about the train logistics for this inventory due to time constraints. Perhaps this is information could be included in future inventories.

What is important for carbon inventory purposes is that the Roosevelt Landfill practices methane recovery and generates electricity. The process of turning this methane gas into electricity ultimately reduces Evergreen's overall emissions footprint

Table 18. *Evergreen's Greenhouse Gas Emissions from Landfilled Waste and from Transporting that Waste to the Roosevelt Landfill in Klickitat County, WA for FY 2004-06.*

Fiscal Year	Landfilled Waste (Short tons)	Emissions Coefficient	Evergreen's Emissions (MTCDE)	Diesel Fuel Per Year (Hawk's Prairie to Centralia)	Emissions Coefficient	Evergreen's Emissions (MTCDE)	Total Emissions from Landfilled Waste (MTCDE)
2004	311	0.1467 MTCDE/short ton	**45.6**	146	0.01 MTCDE/gallon	**1.5**	**47.1**
2005	318	0.1467 MTCDE/short ton	**46.7**	146	0.01 MTCDE/gallon	**1.5**	**48.2**
2006	319	0.1467 MTCDE/short ton	**46.8**	146	0.01 MTCDE/gallon	**1.5**	**48.3**

and therefore has a unique emissions coefficient (Table 18). It is important to record and track the amount of solid waste produced by the campus as it is an annual source of greenhouse gas emissions. Evergreen produces just over 300 short tons of landfilled waste per year that emits just under 50 metric tonnes of greenhouse gases annually (Table 18).

Landfill Waste

- Data Requested: Short tons of landfill waste per year.
- Data Received: pounds of solid waste from 2004-2006 Evergreen:
    - 2004: 622,990 pounds or 311 short tons;
    - 2005: 636,278 pounds or 318 short tons;
    - 2006: 637,200 pounds or 319 short tons.

- Data Received by: Facilities Motor Pool Coordinator (Sherry Parsons).
- Comments: I needed to convert pounds to short tons. The conversion is 1 short ton equals 2,000 pounds or 1 pound equals 0.0005 short tons.

Landfill Waste (Transported from Hawk's Prairie to Centralia):

- Data Requested: Total gallons of diesel fuel used in order to bring Evergreen's landfill waste from the Hawk's Prairie Transport Station to Centralia.
- Data Received: Average fuel economy (mpg), gallons of diesel fuel per roundtrip, annual trips to Centralia to bring Evergreen's landfill waste from Hawk's Prairie (Table 17).
- Data Received by: Introduction to Environmental Studies Program (Student Project – *Why we should care, why we must act: TESC Carbon Budget, Preliminary Report*, March 2007), instructed by Rob Cole and Dylan Fischer.[14]
- Comments: Because there was no separate category in the calculator for the amount of diesel used per year (146 gallons) to transport landfill waste, I entered this data under College Fleet (Diesel).

***Table 19**. Evergreen's Annual Greenhouse Gas Emissions from HFC-134a Refrigerant Chemical Use in College Chiller, Refrigerators, and Water Coolers.*

Source	Estimated Rate of Loss Per Year	Emissions Coefficient	Evergreen's Emissions (MTCDE)
800-Ton Chiller	50 pounds	0.59 MTCDE/lb	**29.5**
Refrigerators	20 pounds	0.59 MTCDE/lb	**11.8**
Water Coolers (including drinking fountains)	5 pounds	0.59 MTCDE/lb	**3.0**

TOTAL EMISSIONS = 44.3

~ Refrigerant Chemicals ~

Evergreen has an 800-ton chiller, water fountains, and refrigerators across campus that use HFC-134a refrigerant. HFC-134a is a hydrocarbon that meets all the

[14] A copy of this report can be requested by contacting Evergreen faculty member Rob Cole.

required standards specified by the EPA in order to reduce the rate of ozone depletion. Unfortunately, hydrocarbons are powerful greenhouse gases. HFC-134a, for example, has a global warming potential of 1,300 (meaning that it is 1,300 times more potent as a greenhouse gas than carbon dioxide). Therefore, it is important to calculate the amount of HFC-134a refrigerant Evergreen uses on an annual basis. Currently, HFC-134a accounts for over 40 metric tonnes of greenhouse gas emissions annually (Table 19).

HFC-134a for 800-Ton Chiller

- Data Requested: Pounds of HFC-134a used on an annual basis.
- Data Received: Seventy-five pounds of HFC-134a refrigerant used per year. This was an estimate of refrigerant lost annually from Evergreen's 800-ton chiller, water fountains, and on-campus refrigerators.
- Data Received by: Facilities College Engineer (Rich Davis).
- Comments: York is the company that manufactures centrifugal water chillers and is responsible for checking and filling Evergreen's chiller. In order to get the amount of HFC-134a refrigerant that Evergreen uses, facilities had to contact them for this information. Unfortunately, they never returned facilities calls and Rich had to estimate the amount of refrigerant used on campus. This will be the last carbon inventory before Evergreen installs a new 1,000-ton chiller (also using HFC-134a). Therefore, Evergreen's emissions will increase from refrigerant chemical use in future inventories.

***Table 20**. Evergreen's Gross Greenhouse Gas Emissions, FY 2004-06.*

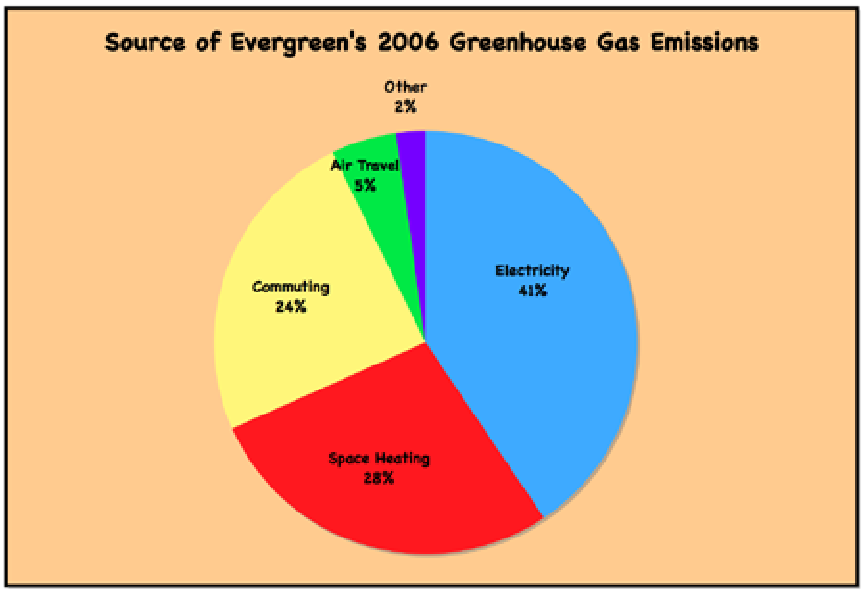
Source of Emissions	2004 Emissions (MTCDE)	2005 Emissions (MTCDE)	2006 Emissions (MTCDE)
Electricity	8,298	8,740	8,954
Space Heating/Hot Water	5,845	5,719	6,171
Commuting	5,347	5,421	5,392
Air Travel	NA	1,419	1,077
College Fleet	281	272	292
Food Delivery	NA	NA	126
Fertilizer/Animal Agriculture	8	8	8
Solid Waste	47	48	48
Refrigerant Chemicals (Space Cooling)	44	44	44
Total Greenhouse Gas Emissions:	**19,870**	**21,671**	**22,112**

~ Evergreen's Gross Greenhouse Gas Emissions ~

With only three years of reliable data it is difficult to make general statements about trends. However, one trend was clear. Evergreen's electricity use increased annually and comprises the single largest source of greenhouse gas emissions (Table 20). In fact, in 2006, Evergreen's electricity consumption *and* combustion of natural gas (for space heating) both increased from 2004 and 2005 levels. As a result, Evergreen emitted more metric tonnes of greenhouse gases in 2006 than in either 2004 or 2005. It should be noted however, that the 2006 inventory took into account more sources of emissions than the other two years. Specifically, Fiscal Year 2004 did not include air travel nor food delivery emissions, while Fiscal Year 2005 lacked food delivery data. Obviously, if these data were available gross emissions for the three years would be closer in value. Unfortunately, even when considering the absence of air travel and food delivery data in previous years, Evergreen's annual emission increased in 2006 taking us farther away from our goal of carbon neutrality.

Annually, purchased electricity, space heating, and commuting back and forth to campus account for over 90% of Evergreen's greenhouse gas emissions. In 2006, for example, these three sources of emissions accounted for 93% of Evergreen's 22,112

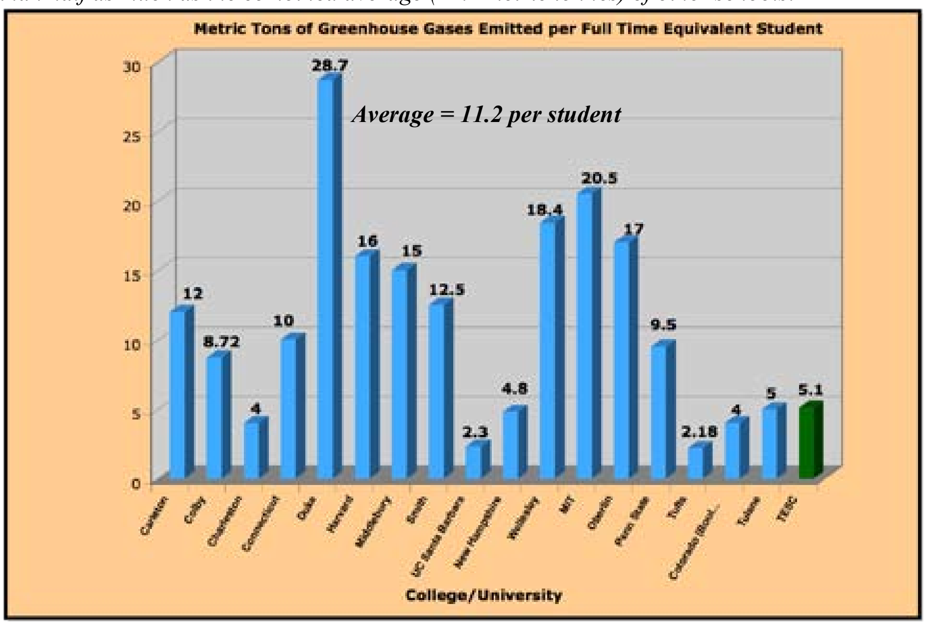
Figure 8. *Source of Evergreen's 2006 greenhouse gas emissions. Electricity consumption, combustion of natural gas for space and water heating, and commuting habits were responsible for 93% of Evergreen's gross emissions. The category "other" equals college fleet, food delivery, fertilizer and animal agriculture, solid waste, and refrigerants.*



metric tonnes of emissions (Figure 8). To put 22,112 metric tonnes in some kind of perspective, one pound of CO_2 could fill 120 party balloons. Therefore, on average, every student, faculty and staff member at Evergreen emits 1.1 million balloons worth of greenhouse gases.

How does this compare to other institutions? In short, quite well. The average of 17 other campuses (who have completed their carbon inventories) is 11.2 metric tonnes per full-time equivalent student (Figure 9). Evergreen averages less than half as much emissions (5.1 metric tonnes) per full-time equivalent student.

Figure 9. *Average greenhouse gas emissions per full-time equivalent student for 17 campuses across the U.S. Evergreen averages 5.1 metric tonnes per full-time equivalent student or less than half as much as the combined average (11.2 metric tonnes) of other schools.*



~ *Offsets* ~

Thus far we have examined Evergreen's activities that contribute to global warming by placing greenhouse gases into the atmosphere. However, Evergreen has also undertaken certain activities (composting and forest preservation) and initiated certain policies (Clean Energy Initiative) that partially offset our emissions. Generally, speaking, offsets are any activity that 1) removes greenhouse gases from the atmosphere (i.e. carbon sinks), 2) avoids adding greenhouse gases into the atmosphere (i.e. methane capture and destruction), or 3) increases the amount of energy produced from clean, renewable sources (i.e. investing in windfarm projects). The quantity of Evergreen's offsets are summed up in Table 21 and will be considered in turn below.

Table 21. Evergreen's Annual Greenhouse Gas Offsets, FY 2004-06.

Offsets	2004 Offsets (MTCDE)	2005 Offsets (MTCDE)	2006 Offsets (MTCDE)
Green Tags	0	0	6,584
Composting	18	28	4
Forest Productivity	757	757	757
Total Greenhouse Gas Offsets:	**775**	**785**	**7,345**

Evergreen Forest

The purest way for Evergreen to achieve carbon neutrality would be if the amount of greenhouse gases removed or absorbed from the atmosphere by Evergreen's forest and through composting equaled its total emissions. Evergreen contains 1,033 acres of forest on its Olympia campus. The trees within this forest, like all plants, store carbon. The United States Forest Service estimates that the average northwest forest contains 93 metric tonnes of stored carbon per acre (Birdsey, 1992). Using this value we can estimate the total amount of stored carbon in Evergreen's forest to be around 96,069 metric tonnes of carbon.

More importantly, as the trees on Evergreen's campus continue to grow they continue to remove carbon from the atmosphere through photosynthesis. More specifically, trees take in CO_2, water and sunlight and convert it into glucose ($C_6H_{12}O_6$). Glucose serves as food for further growth. Therefore, Evergreen's trees should not only be viewed as a carbon storage center but also as an annual carbon sink that may be calculated in the inventory. Does Evergreen's forest absorb enough carbon to render our college carbon neutral?

In order to determine the amount of carbon absorbed by Evergreen's trees, one needs to study the productivity or annual growth rate of the trees. Researchers at Evergreen are in the process of doing this now and preliminary results may be available later in 2007. I say preliminary because an accurate data set requires a multi-year study that mitigates a potential year where growth conditions were high above or below the norm. Either way, even these initial results were not available at the time of this inventory.

Even so, Evergreen's trees are only one component of Evergreen's forest ecosystem. In order to determine the role the forest plays in Evergreen's carbon inventory one needs to take a more holistic approach and measure total forest carbon. Measuring total forest carbon must consider each of the four forest components:

1) Trees – rate of growth and level of decomposition;

2) Understory Vegetation – saplings, shrubs, bushes, etc.;

3) Forest Floor – dead organic matter, litter humus, woody debris, etc.;

4) Soil – it is estimated that the vast majority of organic carbon in any forest ecosystem is locked up in the soil. Therefore, measuring the organic matter in the soil should be considered necessary when evaluating the role Evergreen's forest ecosystem plays in the carbon inventory.

The point is, Evergreen's forest is actually a separate carbon budget complete with its own sources and sinks. Trees not only absorb carbon (acting as a sink), but also "breathe" it out through respiration (acting as a source). The difference between a tree's rate of absorption and respiration of carbon is called its net primary productivity (NPP). Even determining NPP will not give a final answer to a forest's overall carbon budget. After all, leaves and trees themselves decompose and release carbon after death. Determining rates of decomposition, soil types, species of trees present, their age class, other kinds of plant species, animal species, and natural disturbances (such as fires, wind storms, insect outbreaks, etc.) all interact affecting the forest's overall rate of carbon budget. Complex indeed. Once again the United States Forest Service researchers have estimated that the average northwest forest absorbs 0.568 metric tonnes of carbon per acre per year (Birdsey, 1992). Using this figure reveals that Evergreen's total forest carbon sequestration is approximately 586.7 metric tonnes per year.

Unfortunately, the forest ecosystem contained on Evergreen's campus may be profoundly different in character and composition than a forest found in south central Alaska or interior Idaho. Therefore, any estimation over this vast region may not leave us feeling very confident in these numbers. On the spot field study would help remove some of the uncertainty in the numbers. Fortunately, Evergreen has a team of researchers along with committed academic programs that have already initiated a long-term in-depth study of Evergreen's forest. Over the years, their research will contribute data to the rate of sequestration of Evergreen's forest. Their work is titled The Evergreen Ecological Observation Network (EEON) and information is available from their website at http://academic.evergreen.edu/projects/EEON/. Also, I suggest that whoever completes Evergreen's next carbon inventory checks directly with Evergreen faculty members

Dylan Fischer, Carri LeRoy, and Paul Przybylowicz. They oversee the EEON project and can be an invaluable source of information on forest carbon sinks.

For this inventory, I used the research from the 2007 Introduction to Environmental Studies program (co-taught by Dylan Fischer and Rob Cole). The students here combined data specific to Evergreen's forest structure along with peer-reviewed research on rates of forest sequestration to make an initial estimation for Evergreen's forest. They concluded that Evergreen's forest sequesters approximately 757 metric tonnes of carbon dioxide equivalent every year.

Composting

According to the EPA (2002b), composting can lead to carbon sequestration for a few different reasons. First, adding compost to depleted soils raises the overall carbon level of the soil by adding organic matter. Second, nitrogen (contained in compost) stimulates increased plant growth that serves as a carbon sink. Third, composting stabilizes carbon compounds, such as humic substances, that can be stored in the soil for long periods of time (over 50 years). For these reasons, it is worth recording how much composting Evergreen does and the estimated amount of annual carbon sequestration (Table 22).

Table 22*. Evergreen's Rate of Greenhouse Gas Sequestration from Composting at the Organic Farm for FY 2004-06.*

Fiscal Year	Composting	Sequestration Coefficient	Evergreen's Rate of Sequestration (MTCDE)
2004	100 short tons	0.18 MTCDE/short ton	**18.0**
2005	150 short tons	0.18 MTCDE/short ton	**27.0**
2006	23 short tons	0.18 MTCDE/short ton	**4.1**

- Data Requested: The amount of compost per year in short tons.
- Data Received: short tons of compost per year from 2004-2006:
  - 2004: 100 short tons;
  - 2005: 150 short tons;
  - 2006: 23 short tons.
- Data Received by: Organic Farm Manager (Melissa Barker).
- Comments: In 2006, the Organic Farm experienced problems with their composting facility and was forced to significantly reduce the amount of food scraps they were able to accommodate.

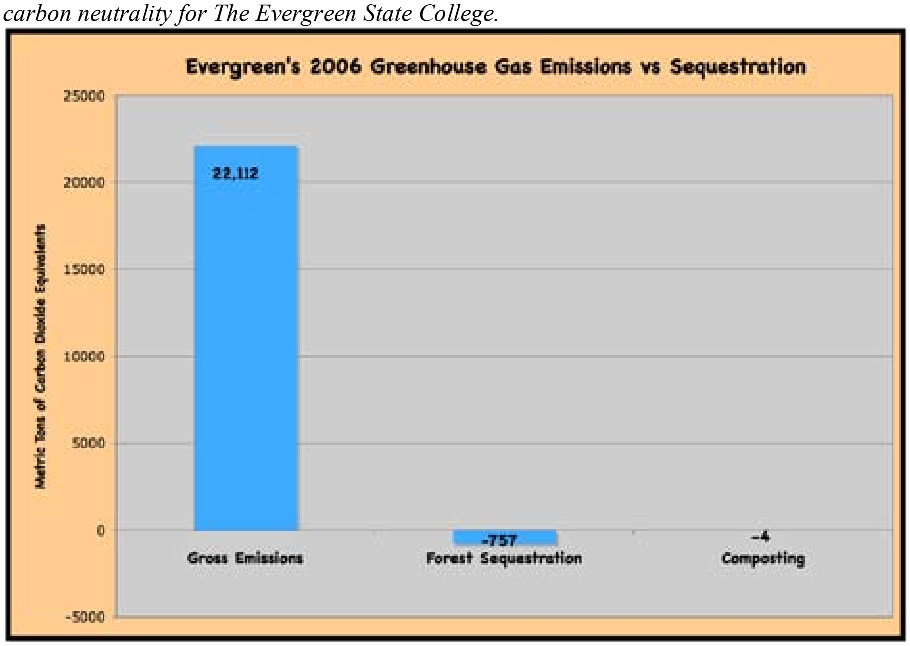
Annually, forest sequestration combined with carbon intake from composting accounted for a small percent of Evergreen's annual rate of greenhouse gas emissions (Table 23). In other words, Evergreen's carbon budget is out of balance and strongly

Table 23. *Carbon Inventory: Evergreen's Net Greenhouse Gas Emissions, FY 2004-2006.*

Fiscal Year	Gross Emissions (MTCDE)	Sinks (MTCDE)		Net Emissions
		Forest Preservation	Composting	
2004	19,870	757	18	19,095
2005	21,671	757	28	20,886
2006	22,112	757	4	21,351

skewed towards the emissions side of the equation. In 2006, for example, Evergreen emitted 21,351 metric tonnes more greenhouse gases than it absorbed (Figure 10). This is problematic because Evergreen's forest may be at or near its maximum rate of carbon

Figure 10. *Evergreen's 2006 gross greenhouse emissions compared to the estimated rate of carbon sequestration from the forest ecosystem and composting. Any strategy focusing solely on increasing the rate of carbon sequestration from these two sources will not achieve carbon neutrality for The Evergreen State College.*



absorption. As forests continue to mature the annual rate of absorption is thought to decrease. And, composting alone cannot make up the difference. Evergreen would have to compost approximately 120,000 tons of food scrap annually to offset Evergreen's current emissions. This is 5,000 times greater than our current level of composting of 23 tons. Evergreen does not have the capacity or produce enough food scraps to make this a reality. Therefore, achieving carbon neutrality has to come from a combination of reducing overall emissions and purchasing carbon offsets from retail providers.

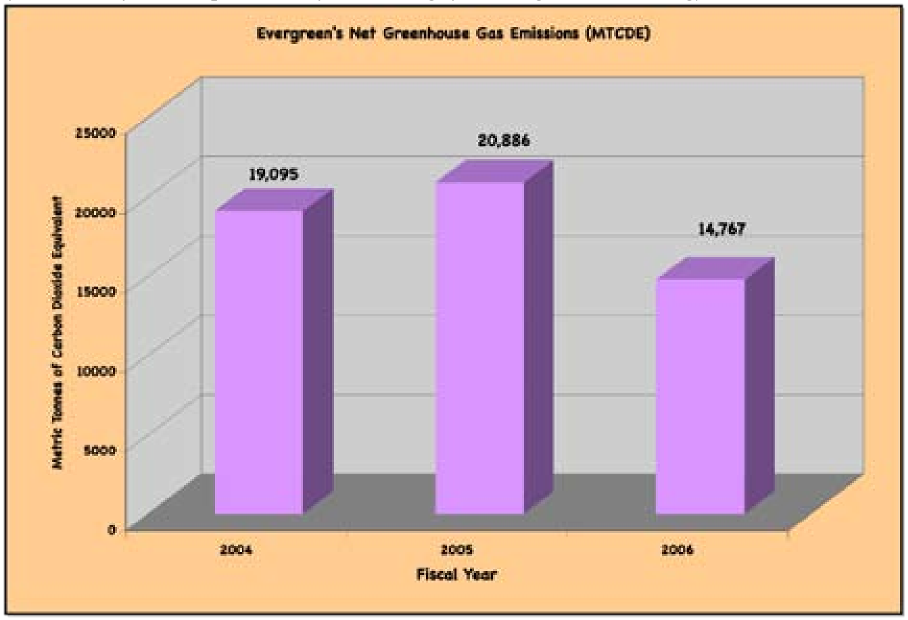
Renewable Energy Credits or Green Tags

In the winter of 2005, Evergreen students voted in favor (91% of those who voted, voted yes) of a self-imposed clean energy fee. As a result, every student currently pays $1.00 per credit, every quarter, in order to purchase Renewable Energy Credits or Green Tags from Evergreen's energy providers (Puget Sound Energy and Tacoma Public Utilities). Because of this student vote, Evergreen now offsets 100% of our electricity purchases with third party qualified renewable sources (wind, solar, biomass, etc.).

So, what exactly does this mean for Evergreen's carbon inventory? Simply put, it has the potential to balance Evergreen's emissions from electricity to zero. Why? Because for every megawatt-hour of electricity Evergreen uses, we pay for another megawatt-hour of electricity to be produced by a new clean energy facility. All in all, it means that Evergreen is investing in clean, renewable energy. Most importantly the money Evergreen spends to purchase Green Tags is invested in *new* green energy projects that might not otherwise be feasible. Puget Sound Energy purchases the Green Tags from the Bonneville Environmental Foundation that is Green-e certified. Green-e is a third party regulator who pre-certifies every Green Tag to assure that the money is spent on qualified renewable sources and that they are not double-counted. Because Evergreen buys Green Tags, and therefore pays for new clean, renewable energy production, Green Tags are frequently considered legitimate offsets for any institution's carbon budget. Regardless, purchasing Green Tags does not alleviate Evergreen's responsibility to reduce electricity consumption (as long as it contributes greenhouse gas emissions).

Evergreen began purchasing Green Tags in October of 2005. That was 3½ months into Fiscal Year 2006. As a result, Evergreen did not purchase enough Green Tags to offset the entire year. More specifically, Evergreen purchased 12.1 million kWh worth of Green Tags but used 16.5 million kWh of purchased electricity. Starting in Fiscal Year 2007, Evergreen will achieve its stated objective of offsetting 100% of its electricity purchases.

Figure 11. *Evergreen's annual net greenhouse emissions including purchase of Green Tags. In 2006, Evergreen's gross emissions were greater than in 2004 and 2005, however, Evergreen's net emissions in 2006 were lower because Evergreen offset 6,584 metric tonnes of emissions from the purchase of Green Tags from Puget Sound Energy.*



~ Balancing Evergreen's Carbon Budget ~

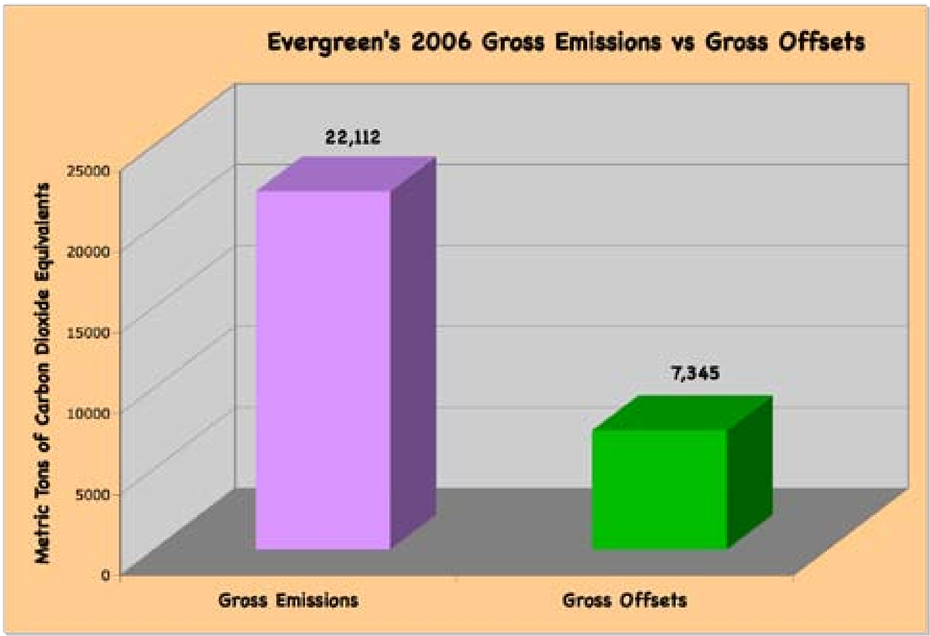
Once Evergreen's data is collected and converted into metric tonnes of carbon dioxide equivalent it is time to perform the calculation that will result in Evergreen's annual carbon budget. I had reliable data from 2004-2006. Therefore, I calculated a budget for those three years. For each year, I totaled the levels of emissions from the energy, transportation, agriculture, solid waste, and refrigerant chemicals sectors. The result is Evergreen's gross emissions. From this sum, I then subtracted the total offsets (Green Tags, composting, & forest productivity). The result is Evergreen's net emissions (Figure 11). In 2006, Evergreen's net greenhouse gas emissions were 14,767 metric tonnes of carbon dioxide equivalent (Figures 11 and 12). The Evergreen State College would need to reduce greenhouse gas emissions by over 1,000 metric tonnes per year to meet the specified goal of carbon neutrality by 2020.

~ Summary of Inventory Results: Key Discoveries ~

The process of completing The Evergreen State College's comprehensive greenhouse gas inventory and the results of that inventory has revealed several key discoveries. In summary, these discoveries are:

- ***Data acquisition is time consuming.*** By far the most time consuming aspect of completing Evergreen's greenhouse gas inventory was gathering the necessary data. I spent the better part of 10 weeks emailing, calling, and meeting with numerous community members in order to gather the necessary data. Whoever completes Evergreen's next inventory should allow for ample time to request and gather the necessary data.
- ***Purchased electricity, combustion of natural gas for space heating, and commuter habits account for over 90% of Evergreen's greenhouse gas emissions.***
- ***Evergreen's gross greenhouse gas emissions per full-time equivalent student (5.1 metric tonnes of carbon dioxide equivalent) are comparatively low.*** Again, the average of 17 different colleges equaled 11.2 metric tonnes per full-time equivalent student. Furthermore, Evergreen's value does not take into account any offsets. If one chooses to include net greenhouse gases per full-time equivalent student the value is much lower.
- ***Evergreen's commuter emissions are comparatively high.*** Evergreen's rural location means that many students and nearly all staff and faculty need to travel further distances to get to campus than most other institutions. As a result, 24% of all of Evergreen's greenhouse gases are emitted by commuters. This is a significantly higher proportion than most other institutions that I looked at.
- ***Evergreen will need to average a 1,000 metric tonne reduction of greenhouse gas emissions per year in order to achieve carbon neutrality by 2020.***
- ***Ultimately, Evergreen will need to purchase offsets from the retail market in order to accomplish carbon neutrality.*** That is, unless Evergreen somehow produces on-campus energy from clean, renewable sources *and* figures out a way to eliminate greenhouse gas emissions from commuting while at the same time increasing the rate of carbon uptake from our forest and compost.

Figure 12. *Evergreen's 2006 gross greenhouse emissions compared to Evergreen's gross offsets (the combined rate of carbon sequestration from the forest ecosystem, composting, and purchase of Green Tags from Puget Sound Energy). In 2006, Evergreen's net emissions were 14,767 metric tonnes of carbon dioxide equivalent. The Evergreen State College would need to reduce emissions by over 1,000 metric tonnes per year to meet the stated goal of carbon neutrality by 2020.*



CHAPTER 8

Where does Evergreen go from here?

Next Steps/Recommendations

- ***Establish Greenhouse Gas Data Collection as an Institutional Priority.*** Significantly reducing greenhouse gas emissions will not be easy. It will take a dedicated community who not only comprehends the issue but also is capable of making significant operational and behavioral changes. This sort of commitment requires strong administrative leadership. Evergreen's administration has already demonstrated that our college is dedicated to the issue of global warming. Now, they will need to communicate this to the rest of the Evergreen community. When change happens and difficult decisions are made (in order to reduce greenhouse gas emissions), the Evergreen community will need to understand, clearly, why these changes are important. The Evergreen community will need to understand the threats of global warming to our region as well as the opportunities available as a reward for decisive action.

  One immediate step the administration can take is to communicate the importance of Evergreen's carbon inventory. Because we already know that Evergreen's carbon inventory will need to be completed on a regular basis[15] and because we already know what data is needed, Evergreen's staff should collect the data in real-time and have it readily available upon request. The best way to make this happen is if it is clearly expressed and made a requirement by Evergreen's administration. In other words, staff members should be notified that they are expected to provide relevant greenhouse gas emissions data in a timely manner. To help facilitate this, I created a summary page (Appendix B) that lists what information is needed and what departments are expected to provide it.

  Obviously, one of my greatest concerns for whoever carries out the next inventory is that they will have to go through the process of explaining what the inventory is, why it is important, and what data they need all over again.

[15] The Presidents Climate Commitment recommends that member institutions update their carbon inventory every two years and report this information to the Association for the Advancement of Sustainability in Higher Education (AASHE).

Repeating this process is so time consuming that I doubt whether any student, student group, or academic program could gather the data, perform the calculations, and summarize the results within a 10-week timeframe. Furthermore, I am concerned that the quality of the data will fail to improve or even degrade. These possibilities could jeopardize the completion of future inventories and threaten Evergreen's progress to reduce greenhouse gas emissions. On the other hand, if Evergreen's emissions data is routinely collected and readily available upon request, the quality and process of repeating Evergreen's carbon inventory will improve. Then, more energy can be spent on evaluating the results and communicating them to the Evergreen community.

Commuting habits are one specific problem. In order to evaluate the amount of annual fuel used by Evergreen commuters I had to rely on data extrapolated from Evergreen's 2005 Commute Trip Reduction Survey for staff and faculty. This data set sufficed for this inventory but it should be noted that a small percentage (27.4%) of Evergreen employees completed the survey and it is not random. Community members complete the survey on a volunteer basis – that could skew the results. For example, it is a possibility that staff and faculty members who use alternative modes of travel (i.e. walk, bus, carpool, etc.) are more likely to complete the survey because they are proud of their behavior. Furthermore, the Commute Trip Reduction Survey does not include information on student commuting behavior. For that information I relied upon the 2006 Student Experience Survey available through Institutional Research. Unfortunately, there is no guarantee that this survey will be repeated in the future. If not, the quality of the data would be degraded for a significant component of Evergreen's overall emissions. As previously mentioned, Parking Services currently conducts parking lot counts three times daily. As far as I know, this data is not being used by anyone and does not provide useful information for the carbon inventory. Perhaps these efforts can be changed to better capture appropriate data for all of Evergreen's commuters (i.e. ratio of drivers who commute alone, number of carpoolers, distance of commute, trips per week, weeks per year, etc.).

Air travel presents another potential problem. Unless the air travel department is notified that they are expected to provide annual air travel miles staff members will be forced to rifle through receipts again when it is time complete the next inventory. This is not only frustrating work but time consuming also. Furthermore, someone then has to calculate the distance traveled for each and every flight. Determining the distance between airports for hundreds of flights took two complete workdays. Because this is now important institutional data it should be captured at the time the flight is issued and maintained in a database that sums the total distance traveled of all flights. If the next inventory is completed in 2009, then it should not come as a surprise to anyone when air travel miles are requested once again.

- ***Rethink Goal of Carbon Neutrality by 2020. Change to Carbon Neutral by 2009?*** I strongly recommend that the Evergreen community achieve carbon neutrality by FY 2009. How? By purchasing greenhouse gas offsets from the retail market. Currently, Evergreen has the opportunity to invest in new renewable energy projects, reforestation projects, energy efficiency projects, methane capture and destruction projects, and others by purchasing offsets from any of 35 retail carbon offset providers.

  The average offset sells at $10/metric ton (Clean-Air Cool-Planet, 2006a). Therefore, Evergreen could become carbon neutral (at current levels of emissions) at an estimated cost of $147,670 annually (or 0.15% of Evergreen's 2006 operating budget). To be sure, there is widespread pushback coming from environmental groups and higher education institutions that it is improper to "purchase" one's way to carbon neutrality without making a substantial effort to reduce emissions. In Evergreen's case, this does not make much sense. There are several reasons why:

  1. I believe that "neutralizing" Evergreen's carbon footprint cannot wait until 2020 or any date too far into the future. Due to the severity of the problem and the need to reduce emissions as soon as possible, I think postponing investment in quality offset projects is immoral.
  2. It seems to be assumed that once a company or institution purchases offsets they will abandon their responsibility to further reduce emissions. In Evergreen's case this is highly unlikely. This community is far too principled to avoid responsibility on the global warming issue. It seems more than reasonable, that the best

policy would be a combination of establishing short-term reduction strategies and targets coupled with the purchase of high quality offsets.

3. Evergreen already has comparatively low per student emissions. In fact, as mentioned earlier, Evergreen's emissions per full-time equivalent student is less than half the average of other institutions. When has a "substantial effort" to further reduce emissions been reached? In Evergreen's case, it seems reasonable to conclude that this threshold has been achieved.
4. Everyday that goes by where Evergreen does not hold itself financially accountable for contributing to global warming is at best a statement that global warming is not a priority and at worse an affront to future generations. In essence, avoiding the purchase of carbon offsets is a statement that Evergreen does not believe it should internalize the cost of global warming and we are passing this burden on to future generations.
5. For nearly 2 years now Evergreen students have been digging into their pockets to purchase Green Tags from Puget Sound Energy. Student money has helped finance local wind projects and helped to increase clean, renewable energy coming into our regional electric grid. It is time for the rest of the Evergreen community to follow suit and equally contribute. This would be a wonderful message to Evergreen's student body and the rest of the Olympia community.
6. Evergreen could leverage its purchasing power to improve the retail offset market. Perhaps this is the most far-reaching and influential reason why Evergreen ought to purchase retail carbon offsets. Currently, there are no standards and no clear assurance that purchasing offsets meets the intended purpose. Through careful research and by demanding project transparency and evidence of additionality, Evergreen has the power to help improve the quality of offsets being provided to the average consumer. The fact is, the only way Evergreen and countless other institutions are going to achieve their carbon neutrality goals are through the

purchase of retail offsets. Evergreen can play an important role in helping to improve that market. And that brings me to my seventh and final point.

7. Eventually, Evergreen is going to have to purchase more offsets to meet the goal of carbon neutrality. So, why wait?

- ***Establish Short-term Emissions Reduction Targets.*** Regardless of when Evergreen achieves carbon neutrality (whether it is in 2020 as specified in the college's updated Strategic Plan or in 2009 as suggested above), our college needs to establish specific greenhouse gas reduction targets. Again, the ultimate goal is to reduce greenhouse gas emissions. This is even more important than achieving carbon neutrality. Therefore, I suggest the following challenging but feasible goals of reducing greenhouse gas emissions:
  - *15% below 2006 levels by 2012.* If this goal is established and achieved it would be a reduction of 3,317 metric tonnes of greenhouse gases by 2012.
  - *40% reduction of 2006 levels by 2020.* This would eliminate 8,845 metric tonnes of greenhouse gas emissions.
  - *80% reduction by 2050* (the target agreed upon by the Intergovernmental Panel on Climate Change to avoid the worst impacts of global warming). This would eliminate 17,690 metric tonnes of emissions leaving Evergreen with a gross emissions value of 4,422 metric tonnes.

  See Appendix C for a list of climate commitments and emissions reduction targets established by other institutions of higher education.
- ***Establish and Implement Greenhouse Gas Reduction Strategies.*** This involves research and a discussion worthy of another thesis. Nevertheless, it is an important next step if Evergreen is going to achieve significant emissions reductions. I would suggest that any strategy look at each of the three main contributors to Evergreen's gross emissions (purchased electricity, combustion of natural gas, and commuter behaviors) and determine short-term and long-term strategies to reduce emissions, piecemeal.

- ***The Sustainability Task Force Formally Establishes Global Warming as a Major Sustainability Issue and Dedicates itself to Advancing Evergreen's Global Warming Initiatives.*** As a result, the timely completion of future greenhouse gas inventories fall under the purview of the Sustainability Task Force.

CONCLUSION

Global Warming: A Year to Remember

How will this past year be remembered? Will it be remembered for today's horrific war in Iraq? How about the global war on terrorism? Will Americans long remember today's debate over immigration reform or the so-called domestic spy program? Hardly. Global warming, on the other hand, will be familiar to everyone, everywhere for a long time to come. Polar icecaps will continue to melt away while sea-level and global air temperature will continue to rise well into the next century. A hundred years from now, the consequences associated with those trends will influence everyday life. Lag times in the climate system, the long persistence time of atmospheric greenhouse gases, and the fact that global emissions continue to rise ensure that global warming will still be an issue for 22^{nd} century citizens. Future generations will understand, clearly, that it was our 25 billion tons of annual greenhouse gas emissions that is the root cause of their climate problems. Historical records will also remind them how we basically ignored over 20 years of international scientific consensus that global warming was not only happening but that our activities were the driving force. So, how will future generations remember us? I am going to guess, unfavorably. However, it doesn't have to be this way. It is never too late to redefine our legacy. And, that is exactly what we are doing.

Changing The National and Global Conversation

Few could have imagined only one year ago how the issue of global warming would come to dominate the national conversation. Al Gore introduced Americans to an "Inconvenient Truth," Thomas Friedman encouraged Americans that "Green" is "The new Red, White and Blue," and Tom Brokaw emerged from retirement just to tell you "What You Need to Know" about global warming. And, if you don't watch much TV, then reading the headlines on any given day would have likely taught you something new about global warming. This past year also saw the U.S. Supreme Court rule that greenhouse gases are pollutants and that the EPA is responsible for regulating them. Just what kind of impact this decision will have is yet to be determined, but some are calling it the most important environmental decision the Supreme Court has made in decades.

Internationally, Britain's chief economist, Sir Nicholas Stern, published the most extensive report thus far detailing the economic impacts of global warming. The so-called Stern Review concluded that global efforts to reduce greenhouse gas emissions could cost the world about 1% of its annual GDP. While the impacts of global warming, under a "do nothing" scenario, could cost the world upwards of 20% of its annual GDP. And, of course, the most widely anticipated international report on global warming was also published this past year. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change ended any doubt as to whether global warming is happening and ended any reasonable doubt as to whether human activities are a main contributing factor.

From Talk to Action?

So, has all this talk led to any action? Yes. Many companies, organizations, institutions, and local governments have established climate policies. Most, like the U.S. Mayors Climate Protection Agreement, are commitments to reduce greenhouse gas emissions by a certain percentage by a certain date (i.e. 7% below 1990 levels by 2012). Others are striving for carbon neutrality. In fact, "carbon neutral" has become so pervasive that the New Oxford American Dictionary selected it as its 2006 "Word of the Year."

What does carbon neutral mean? As we have learned in this thesis, carbon neutrality is achieved when greenhouse gas emissions – through operations and daily activities – are balanced by other activities that offset or remove greenhouse gases from the atmosphere. If every nation, institution, organization, and individual accomplished this, then the human contribution to global warming would effectively end.

What About Evergreen?

As expected, Evergreen has been anything but passive. In November of 2006, Evergreen's Board of Trustees approved the updated Strategic Plan with the stated goal of "achieving carbon neutrality by 2020." Then, on January 18, 2007, President Les Purce joined the Leadership Circle of the Presidents Climate Commitment. An agreement to "achieve climate neutrality as soon as possible." And just recently, Evergreen's administration officially formed a Focus the Nation Steering Committee. The Committee – comprised of faculty, staff, and students – will be organizing a regional event dedicated to global warming solutions.

From Action to Action…

Indeed, for those long concerned about global warming this has been a year to remember. The level of national dialogue and policy implementation crossed a threshold. Global warming is officially mainstream. These are reasons to feel good, but not too good. Avoiding the most serious impacts of global warming will, according to most scientists, require an 80% reduction of greenhouse gas emissions by 2050.

Unfortunately, global emissions continue to rise (not decline as they ought to be). The U.S., which contributes around 22% of global emissions, is the world's leading laggard. A 2007 White House report to the United Nations was discouraging. It projected that the U.S. would increase 2000 level emissions 20% by 2020. China is another major concern. The Wall Street Journal recently reported that last year China built the equivalent of one large coal-fired power plant per week and (perhaps as early as November 2007) they will overtake the U.S. in gross emissions. Not even the Evergreen community can point fingers. According to our recently completed greenhouse gas inventory, our gross emissions have increased every year for the past three years.

Our Legacy

How will this past year be remembered? That depends on our ability to reduce emissions. All the talk and all the policies in the world won't make a difference until emissions begin to decline. The coming generation will not say, "Hey, at least they talked about it" and give us a "good try" pat on the back. They will hold us accountable. Can we succeed? Well, if you believe – like John F. Kennedy believed – that humans are capable of solving all human-made problems, then we better get to work. And, if the global picture is too daunting, then I encourage Evergreen community members to focus closer to home. Small changes can have large effects. Ask, "What will Evergreen's greenhouse gas emissions be next year?" Then, do your part to ensure that they do not increase for the fourth year in a row.

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~ APPENDIX A ~

Estimated food delivery miles traveled per year from vendor distribution center/store to Olympia campus.

Vendor	Vendor Round Trip Distance (Miles)	Deliveries Per Week	Miles Traveled Per Week
Bagel Brothers	6.8	6.0	40.8
Be Bop Biscotti	271.3	0.1	35.3
Black Hills Distribution	10.8	0.3	2.7
Brinks Incorporated	69.8	5.0	349.0
Charlie's Produce	127.6	6.0	765.6
Coca Cola Bottling	62.4	1.0	62.4
Danny's Delivery	11.6	2.0	23.2
Dreyers Grand Ice Cream	108.4	1.0	108.4
EK Beverage	107.2	0.5	53.6
Franz Family Bakery	26.6	5.0	133.0
Frito Lay	21.6	1.0	21.6
Fuji Restaurant	10.0	2.0	20.0
Harbor Wholesale	16.0	1.0	16.0
Healthy Baking	743.5	0.3	185.9
L&E Bottling Company	7.4	1.0	7.4
Mountain People's	92.4	1.0	92.4
Naked Juice	121.2	1.0	121.2
R&K Foods	128.6	2.0	257.2
Revi Incorporated	112.2	0.1	14.6
Service Linen Supply	114.2	2.0	228.4
Sysco Food Service	121.4	2.0	242.8
Tri City Meats	23.2	3.0	69.6
Tully's Coffee	121.4	0.5	60.7

TOTAL MILES TRAVELED PER WEEK 2,911.70

x 52 weeks/yr

TOTAL MILES TRAVELED PER YEAR 151,410

~ APPENDIX B ~

Source and type of information needed for future greenhouse gas inventories at The Evergreen State College

DEPARTMENT	INFORMATION SOUGHT	COMMENTS
The Evergreen Ecological Observation Network	**Total Forest Carbon (MTCDE)**	**Does Evergreen's forest serve as a carbon sink or source? What is the quantity in metric tons? Ideally, estimates should include tree productivity/decomposition, soil carbon content/emissions, understory data, and forest floor sources and sinks of carbon**
Budget & Planning	**Operating Budget and Energy Budget**	
Institutional Research	**Number of full-time, part-time, summer students/faculty/staff**	
Facilities	**Total Building Space (square feet) including Tacoma Campus**	
Facilities	**Electricity purchased in kWh/year and number of green tags purchased per year in kWh**	
Facilities	**On-Campus Stationary Energy Use: Natural Gas (MMBtu), Distillate Oil #2 (Gallons), Propane (Gallons)**	
Facilities	**College Fleet: Gallons of Gasoline and Diesel Fuel Used**	
Facilities	**Fertilizer used for lawn and grounds maintenance (pounds)**	
Facilities	**Landfilled Solid Waste (short tons)**	
Facilities	**Refrigeration Chemicals Used (pounds)**	**Amount of HFC-134a (and other refrigerants) used in Chillers, Water Coolers, Refrigerators, etc.**
Travel Office	**Air Miles Traveled: Student Programs and Faculty/Staff Business**	
Parking	**Student Commuting: Gallons of Gasoline and Diesel Fuel Used Commuting to Campus in Personal Vehicles and by Intercity Transit**	**Need % that drive alone, % that carpool, trips per week, weeks per year, roundtrip miles, average fuel efficiency**
Parking	**Faculty Commuting: Gallons of Gasoline and Diesel Fuel Used Commuting to Campus in Personal Vehicles and by Intercity Transit**	**Need % that drive alone, % that carpool, trips per week, weeks per year, roundtrip miles, average fuel efficiency**
Parking	**Staff Commuting: Gallons of Gasoline and Diesel Fuel Used Commuting to Campus in Personal Vehicles and by Intercity Transit**	**Need % that drive alone, % that carpool, trips per week, weeks per year, roundtrip miles, average fuel efficiency**
Organic Farm	**Number of Farm animals (poultry, pigs, goats, cows, horses, sheep, etc.)**	
Organic Farm	**Fertilizer Use**	**Amount of Fertilizer used (pounds), type of Fertilizer (organic/synthetic), and % Nitrogen**
Organic Farm	**Total Compost (short tons)**	
Aramark	**Gallons of Gasoline and Diesel Fuel Used to Delivery Food to Campus from Vendor Store or Distribution Center**	**Need list of vendors, distance to campus, trips per week, weeks per year, fuel economy, type of fuel used.**

~ APPENDIX C ~

Campus Global Warming Commitments (as of June 2007)

Institution	Commitment	Date of Commitment
College of the Atlantic	Climate Neutrality (Immediately)	October 2006
Cornell University	7% Below 1990 Levels by 2008	April 2001
Middlebury College	8% Below 1990 Levels by 2012 on a Per Student Basis	May 2004
Tufts University	7% Below 1990 Levels by 2012	April 1999
Yale University	10% Below 1990 Levels by 2020	October 2005
Williams College	10% Below 1990 Levels by 2020	January 2007
University of British Columbia	25% Below 2000 Levels by 2010 (only for emissions from buildings)	2006
Bowdoin College	11% Below 2002 Levels by 2010	January 2006
University of Oklahoma	4% Below 1998-2001 Baseline by 2006	January 2004
University of Iowa	4% Below 1998-2001 Baseline by 2007	May 2004
University of Minnesota	4% Below 1998-2001 Baseline by 2008	December 2004
Michigan State University	6% Below 1998-2001 Baseline by 2010	November 2006
University of California System	80% Below 1990 Levels by 2050	January 2006
UNC at Chapel Hill	60% Below 2005 Levels by 2050	June 2006
Oberlin College	Carbon Neutrality (No Timetable)	April 2004
Carleton College	Carbon Neutrality (No Timetable)	May 2006
University of Florida	Carbon Neutrality (No Timetable)	October 2006

TEACHING GARDENS PLANT LIST AND GARDEN DESCRIPTIONS (2007)

Report provided by Frederica Bowcutt offering plant recommendations and descriptions of existing teaching garden themes for consideration in future landscaping endeavors.

Imagine a Greener Future

An Arboretum Plan for The Evergreen State College

Updated for:
The Evergreen State College
Master Plan

Prepared by:
Frederica Bowcutt, Faculty Member
The Evergreen State College

September 2002

(December 2002: Approved by the Campus Land Use Committee and the Faculty)
(February 2008: Abbreviated Text, Updated Map and New Appendices)

"Americans have a deeply ingrained habit of seeing nature and culture as irreconcilably opposed; we automatically assume that whenever one gains, the other must lose. Forced to choose, we usually opt for nature (at least in our books). This choice, which I believe is a false one, is what led Thoreau and his descendants out of the garden. To be sure, there is much to be learned in the wilderness; our unsurpassed tradition of nature writing is sufficient proof of that. But my experience in the garden leads me to believe that there are many important things about our relationship to nature that *cannot* be learned in the wild. For one thing, we need, and now more than ever, to learn how to use nature without damaging it. That probably can't be done as long as we continue to think of nature and culture simply as antagonists. So how do we begin to find some middle ground between the two? To provide for our needs and desires without diminishing nature? …the place to look for some of the answers to these questions may not be in the woods, but in the garden."

Michael Pollan, *Second Nature: A Gardener's Education*, p. 5

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Evergreen Arboretum 2008 Update

In the summer of 2002 the former director of Facilities Michel George commissioned an arboretum plan. Since the plan's approval in the fall of 2002 by the Campus Land Use Committee (CLUC) and the Faculty, nearly all of the proposed teaching gardens have been established.

The goals driving design of these new gardens are:
- Improve educational value of plantings
- Celebrate cultural diversity
- Foster social justice

As well as
- Promote environmentally sustainable garden design
- Create low maintenance designs
- Improve wildlife habitat
- Integrate existing mature trees and shrubs into proposed designs
- Work within existing irrigated beds
- Reduce water and energy usage
- Remove as much lawn as possible while meeting needs for inviting places to sit
- Improve aesthetics in the core of the campus
- Create opportunities for students to link theory with praxis and
- Integrate the arboretum with the forest trail system.

Since 2002, nine new teaching gardens have been added to the campus' first teaching garden, the Longhouse Ethnobotanical Garden. Students created many of the new gardens. Students designed and installed the Waterwise Pollinator Garden and Basket Garden. Students installed the Medicinal Herb Garden at the Organic Farm. Other gardens were added with building renovation or new construction. When the Library roof was renovated in 2003, we added a Prairie Roof Garden. With the construction of the new Seminar II building, we installed four new types of teaching gardens: Native Plant Demonstration Gardens, Rain Roof Gardens, a Post Glacial Forest and a Primitive Plant Garden. By modifying the plantings around the lab buildings we created a Laurasian garden that educates visitors about the influence of continental drift and evolution of the world flora. Seven student designed interpretive panels have been installed. Hundreds of plant identification signs have been put in place. One memorial bench was donated. Alumna Deborah Mersky installed two public art pieces linked to the teaching gardens around SEM II. A directory for the teaching gardens in the core of campus was installed in front of the library building, and a directory was placed next to the Organic Farmhouse with descriptions of the various gardens on the Organic Farm. Both directories were student designed.

In the future we hope to:
- install phase II of the Waterwise Pollinator Garden,

- install the Deer Garden along with interpretive panel,
- augment the Primitive Plant Garden plantings,
- add interpretive panels for the Basket Garden, Longhouse Ethnobotanical Garden, Native Plant Demonstration Gardens, Primitive Plant Garden and Lawns.
- remove lawns designated for removal in the original arboretum plan,
- remove more English ivy and add edible landscaping in the core of campus,
- create a small medicinal herb garden in the core for the Student Health Center,
- create a low maintenance labyrinth,
- add more comfortable seating, and add more public art in the gardens.

A copy of the original plan, "Imagine a Greener Future," is available in our library (Bowcutt 2002). The table below summarizes the progress made towards meeting the goals laid out in the 2002 arboretum plan.

Teaching Garden or Other Expense	Installed	Source of Funds	Left to be done
Basket Garden	√	TESC Facilities paid for plants Student design & installation	Interpretive panel Deer protection Summer irrigation
Deer Garden		Possibly local nurseries plus Dept. of Ecology or other govt. agency	Design and installation
Labyrinth		Design work done by student & proposed to CLUC	Resubmit plans that address maintenance concerns
Laurasian Landscape	in process	Possibly Local Nurseries (plants)	Increase species diversity
Longhouse Ethnobotanical Garden	in process	Donations from the Sierra Club, Elizabeth Wakeman Henderson Foundation and others.	Add memorial garden for Bruce Miller
Medicinal Herb Garden	√	Small General Education Grant	
Native Plant Demonstration Gardens	√	SEM II budget	
Post-Glacial Forest	√	SEM II budget	
Prairie Roof Garden	√	Library Roof Remodel	Repair irrigation; restore failing areas
Primitive Plant Garden	√	SEM II budget	
Rain Roof Gardens	√	SEM II budget	
Waterwise Pollinator Garden	√	City of Olympia & Evergreen Foundation Student design & installation	Phase II including wheelchair access trail/public art
Benches		Possibly private donations and/or created by students	

Directory signs	√	TESC Facilities paid for two	
Interpretive panels	√	TESC Facilities paid for seven	Add six more
Tool Storage space		Included in Longhouse remodel	Build
Sculptural Elements	√	Public Arts Funds from SEM II	Student installations

Critical to the ongoing success of all these gardens is routine weeding and mulching.

Introduction

The original landscaping on the Evergreen State College campus was installed in the late 1960s. The design called for eastern deciduous forest trees, Japanese and other Asian species, and a number of common European ornamentals. A few native trees and shrubs were also intermixed. Now the mature plants provide shade and color. However, the full potential for using the landscaping to educate people about plants and their ecology was not realized. Until 2002 little changed in the landscape design with the notable addition of native plant and medicinal plant gardens around the Longhouse. The arboretum plan proposed modifying existing plantings and creating teaching gardens with interpretive panels and more public art (Bowcutt 2002). Installation of some of the gardens occurred during the construction of SEM II and when the library roof was renovated. Students installed the remaining gardens.

An arboretum creates a draw to our campus. Educators already use the labeled plants to help school children and college students learn about local plants and their ecology. Increasingly the campus is used by neighbors many from new, dense suburban subdivisions. They walk or jog the trails and the campus core. This increased visitation creates opportunities for environmental education including issues around sustainability. By integrating the arboretum with the existing trail system in the roughly thousand acres of native forest surrounding the core campus, we can introduce more people to our community and educate them about local ecology.

At the time landscape architects designed The Evergreen State College landscape, little awareness existed about the invasiveness of English ivy and a number of other common horticultural species. Now many in our community express concern about the use and ecological impact of such plants. Students have removed ivy to make room for native plants in several locations on campus. If fully implemented, this plan would significantly reduce the amount of English ivy and other aggressive non-natives in the core of the campus. Non-invasive species, both native and non-native, will be used to replace them. Along with many invasive species, turf dominates American horticulture and the Evergreen campus is no exception. Lawns, with their high demands for energy and water, do not reflect Evergreen values for sustainable relations with nature. By reducing the amount of turf and replacing it with drought tolerant species we can reduce our water use.

Existing Conditions

Creation of an arboretum on The Evergreen State College campus is based on the premise advocated by Ian McHarg to "design with nature". Poet Gary Snyder says the same thing a little differently. Go with the grain of nature. To do so means less maintenance, less disease, more efficient water use. It means not imposing the will of people on the land without being sensitive to what is already there. To design with nature requires knowing the conditions of the site, including the physical, biological, and human community the gardens will live within. The following is a summary of those preexisting conditions.

Location

The Evergreen State College is located on a peninsula jutting into the south end of the Puget Sound. The campus occurs west of the Cascade Mountains, a volcanic range. It lies within the city limits of Olympia. Most of the 1,000 acre campus is forested with second growth coniferous forests. Douglas-fir (*Pseudotsuga menziesii*) dominates much of the forest along with red alder (*Alnus rubra*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*). For a plant species list and a more through description of the vegetation of the undeveloped portions of the campus see Lohmann 2006. The campus buildings are clustered together and surrounded by forest. Roughly 20 acres of the core of the campus are under irrigation. Irrigated lawns comprise the lion's share. Rough-cut nonirrigated lawns are not included in this figure. Irrigated lawns require high maintenance, energy use and water use. English ivy and periwinkle cover the majority of the remaining grounds with an overstory of both native and exotic trees and shrubs.

Climate

Olympia, Washington enjoys a Mediterranean climate. This means that despite our high rainfall (55" on average), during the months of July, August and September drought conditions exist. For a good general description of the Puget Sound region's climate and weather refer to Arthur Kruckeberg's *Natural History of Puget Sound Country*. As many gardeners know, this region is ideal for growing northern temperate hemisphere plants including those from the Eurasian continent. A variety of arboreta in the Pacific Northwest demonstrate good plant selections for our region.

According to Sunset's *Western Garden Book*, The Evergreen State College occurs in climate zone 5 (Brenzel, p. 36). It is under the marine influence of the Puget Sound with more moderate temperatures than nearby climate zone 4. These zone designations are used extensively by horticulturists and should inform any plant selections for our arboretum. This information enables us to select plants appropriate to the climate and thus to design with nature, not despite it. The danger of frosts as late as May and as early as October means that tropical and subtropical species are not hardy here. Desert species can't tolerate the high rainfall. However, some Mediterranean species from Greece, Italy and southern France can survive on well-drained soils like many created by glacial deposits. Given one of the goals is to create low maintenance plantings, frost sensitive species and beds of annual plants are not appropriate choices.

Microclimatic conditions vary in relation to buildings and this must be taken into account when designing placement of plants. More frost tender plants can thrive against a concrete wall on the south side of a building. The thermal mass created by the building results in heat being radiated back out. Some plants adapted to forest understory conditions and with higher moisture-needs can be badly sun burnt in such a location and may prefer the north side of a building. Since stressed plants are more prone to disease and death, placement for optimal growth is important to meet the low maintenance goal. The *Western Garden Book*, and other garden reference books, can aid in identifying conditions favored by various plants. Consider also monographs on specific genera for more detailed cultivation information.

Soil

All of the soils on campus are derived from glacial deposits or volcanic ash and loess. The predominant soil type in the core of the campus is Alderwood gravelly sandy loam. The authoritative source on the subject of our soils is the *Soil Survey of Thurston County* (Soil Conservation District 1982). It has the following to say about the Alderwood series: "moderately deep, moderately well drained soils on glacial till plains." Soils that drain well can accommodate drought resistant species from Mediterranean regions such as lavender, *Cistus,* and *Santolina*. It's this kind of customizing we need to do when we design gardens on campus using the soil survey data. Skipopa silt loam occurs around the Campus Activities Building (CAB) and to the northeast and east of the Library building. According to the soil survey, it was derived from volcanic ash and wind blown sediments (loess) that was deposited on top of sediment from a glacier caused lake. The soils in the Skipopa series are moderately deep but "somewhat poorly drained." Thus these will probably not be good sites for Mediterranean species as they would be prone to root rot. The soil survey should be field checked by digging holes in areas for different teaching gardens and observing how well water drains. By using the tables towards the back of the soil survey one can determine the capabilities of the various soil types in a very general sense.

Geological Features

In technical terms, Quaternary glacial drift and alluvium characterize the geology of the peninsula the college occurs on. Roughly 14,000 years ago ice hundreds of feet thick covered The Evergreen State College campus. When the Vashon Glacier, the last of several glaciers, receded it left behind a medley of rocky jumble, called till by geologists, and a variety of other deposits including huge rocks called erratics. Runoff from the melting glaciers also left behind sediment and rocks big and small. Large erratic boulders existing on the Seminar II site were used in the Post Glacial Forest.

Teaching Gardens

Our gardens educate about a variety of subjects including basket material access, evolution, geologic history, native plant ecology, water conservation, and wildlife enhancement. Reflected in the design of these gardens are the values of the institution:

fostering communication across significant difference, multiculturalism, social justice and of course a dedication to excellence in teaching. Students have been involved in all aspects of the arboretum's creation. Their involvement reflects one of our foci, linking theory and praxis. Refer to Figure 1 for a map of the teaching gardens.

Basket Garden

In addition to designing a variety of interpretive panels, Teaching Gardens students installed the Basket Garden in fall 2004. Contract student Ben Helmes designed it and supervised its installation including the willow structure, which resembles an upside

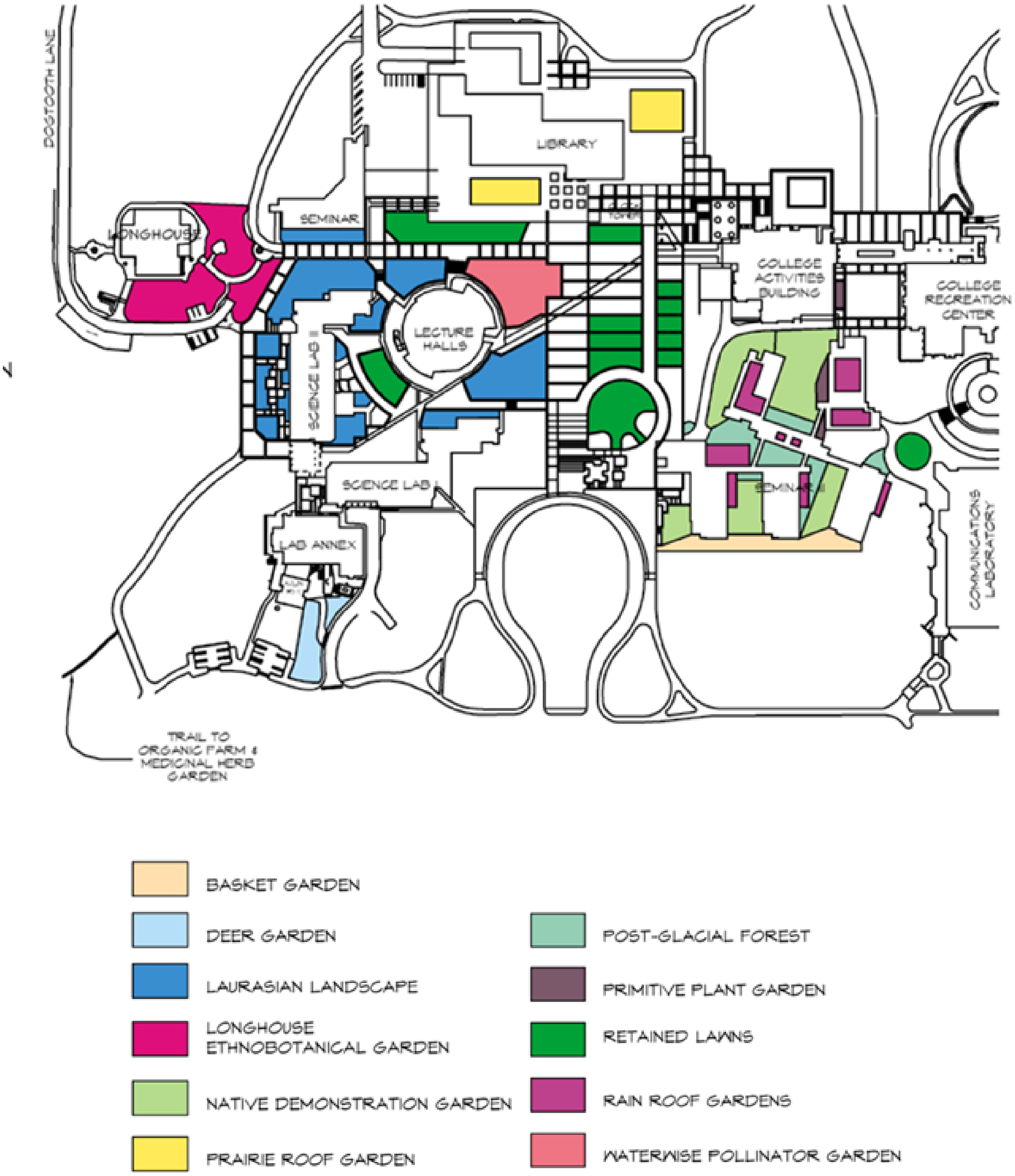

Figure 1. Map of Teaching Gardens

down basket. This garden includes plants used traditionally to make baskets by First Peoples from the Pacific Northwest as well as from other cultural traditions including western red cedar (*Thuja plicata*), red osier dogwood (*Cornus stolonifera*), sedge (*Carex* spp.), beargrass (*Xerophyllum tenax*), and willow (*Salix* spp.). Native activists advocate for botanic gardens to move away from their colonial and imperialist past and address social justice issues. Due to reduced land bases and access to gathering places, many basket makers find it difficult to gather the materials they need to keep traditional arts alive. This garden will eventually produce needed materials but also elevate awareness of the challenges faced by these artists.

Woven into this themed garden is the traditional use of coppice growth. Due to their annual pollarding treatment, the London plane trees in front of the library building produce copious amounts of coppice growth. As odd as it sounds, these poodle trees reflect an indigenous European management technique for making a useful product: straight pliable shoots. Medieval and Renaissance gardeners created wattle fences from the straight shoots (refer to Figures 2 and 3). By integrating the pollarded London Plane trees, the garden points out that European and Euroamerican peoples also have a cultural heritage that includes traditional, indigenous relations with plants.

Figure 2. Wattle fence with a Rammed Earth House (16th century)

Figure 3. Coppice Growth on Pollarded Trees (Italian, 15th century)

Deer Garden

Once installed, this garden will demonstrate plants resistant to deer browse. For example many members of the mint family lack appeal to the deer palate. Plants in this family include sage (*Salvia* spp.), catmint (*Nepet*a spp.), mint (*Mentha* spp.), lemon balm (*Melissa officinalis*), lavender (*Lavendula* spp.). Note that some of these plants can be invasive and this needs to be considered in the design process. They might be contained with barriers. Members of the daisy family also tend to not taste good to deer, such as dahlias, aster, coreopsis, *Rudbeckia*, and *Echinacea*. Deer pass on a variety of poisonous plants such as foxglove, monkshood, and deadly nightshade.
deer garden. Thorny species, like barberry, *Eryngium,* and Oregon grape, prove formidable foe to a soft nuzzle. Deer turn their noses up to leathery rhododendron leaves and highly hairy plants like lamb's ears. They dislike daffodils too. Ornamental sedges, grasses, and ferns can be good choices for the garden visited by deer (see Brenzel, pp. 104-105). Lawns not sprayed with broad-leaf herbicides can be planted with clover to provide a diversion for deer. Given the high number of new homes on the rural-urban interface in Olympia, educating people about coexisting with deer has high educational value. It could reduce the amount of enclosures created to protect plantings. Such enclosures reduce habitat for deer, increasing their impact elsewhere. Local nursery people often have good local knowledge about planting in deer zones. The designers of this garden should avail themselves of such placed-based expertise. *Western Garden Book* lists plants resistant to deer (Brenzel, pp. 152-160). However, note that it doesn't mention that although deer don't browse the leaves of day lilies they relish the flower buds and blossoms. Resist is the operative word. The plants listed are not deer proof, nothing is. Particularly in June when the fawns are newly exploring the world there's a lot of testing going on. Also in winter when times are lean, deer will browse on plants they ordinarily avoid. It's not a perfect system but it does radically reduce damage when plants are selected with deer in mind. This garden could include an interpretive sign about deer including their life cycle and local ecology.

Laurasian Landscape

This garden demonstrates that kinship exists among plants (and thus people) from the North American and Eurasian continents. The garden creates an opportunity to communicate across significant differences about relations between people and closely related plants. For example, indigenous peoples on both continents managed native hazelnuts for coppice growth and nut production. The theme of a Laurasian landscape emerged out of the original plant palette. In the late 1960s many Eurasian species were planted around The Evergreen State College lab buildings. A few natives such as vine maple were also planted. Through signage and additional plants, this garden is used to educate students and outside visitors of the impact of geologic history on plant life. Through geographic speciation, many new species evolved after the Laurasian continent broke apart. However, its two daughter continents, Eurasia and North America still share many genera, e.g. pines, maples, elderberries, hazelnuts, roses, oaks, birch, chestnut, dogwood, and sycamore. In this garden we pair species of the same genera from different continents. They may or may not be immediately adjacent, although proximity is helpful when doing plant walks. All of the plants are labeled with their scientific name along with their place of origin. Common names from their homeland will be provided where possible. A similar garden exists in the National Arboretum called the Friendship Garden. It does not emphasis the evolutionary links between the floras of North America and Eurasia. For linked academic materials see Kruckeberg 1983 and Wen 1999.

Lawns

Our intention through this plan is to reduce the amount of lawns on campus to lower our water and energy use and to create more sustainable and wildlife friendly landscaping. That said, we are not proposing elimination of all lawns. Lawns that are used frequently will be kept. Additional seating in the core will also create alternatives to sitting on lawn. Bench locations will be identified in the planting plans for specific teaching gardens. Where feasible, lawns will be converted to more environmentally sound alternatives (Brenzel 2001, pp. 100-103).

Although most American lawns receive large amounts of pesticides and chemical fertilizers, none of Evergreen's lawns do. As a part of the arboretum we will educate visitors, staff, faculty, and students about our "green" lawns maintained through frequent mowing, leaving clippings, not cutting too short, and watering enough (not too much and not too infrequently). With an interpretive panel we will educate people about the risks pesticides pose. How their use endangers small children as well as pets, birds, frogs, snakes, salamanders, newts and other critters. We will also discuss the amount of labor required to maintain a lawn relative to other kinds of gardening options. For an American cultural history on lawns see Jenkins 1994.

Longhouse Ethnobotanical Garden

In 1995 work on the Longhouse Ethnobotanical Garden began. Faculty member Marja Eloheimo collaborated with students, tribal members, and campus facilities staff to prepare the site and install species representing various habitat areas (e.g., prairie, riparian, mixed forest, middle and high elevation). Many students in a variety of ethnobotany programs have contributed to the creation and maintenance of the native garden in front of the Longhouse. Students installed plant identification signs, including a local Indian language name whenever possible. In conjunction with the garden, students developed a relational database, a small ethnobotanical library and a baseline GIS map. The project was made possible by salvaging plants from development sites and funding from the Sierra Club, the Elizabeth Wakeman Henderson Foundation, and many other donations. Future plans include installation of a student-generated design for construction on the north side of the Longhouse of a medicinal garden organized by body systems. The Longhouse Ethnobotanical Garden was named "s'ulex" by Upper Skagit elder, Vi Hilbert. This word refers to gathering and creating possibilities from what nature offers. It reflects the fact that members of the Indigenous community who utilize and care about the Longhouse support this garden. It also reflects the idea that the garden represents a collaboration between people and plants, and between communities and cultures, especially if we have the means and support to gather and create the possibilities it offers.

Medicinal Herb Garden

Students in the program Christian Roots installed the Medicinal Herb Garden at the Organic Farm in winter 2004. This garden is based on the four square design of Persian origin and common in Europe during the Middle Ages and Renaissance. The Physick Garden at the University of British Columbia in Vancouver inspired the design. This garden is used to promote the medicinal use of easy to grow European plants like chamomile, oregano, lavender, lemon mint, and peppermint. This garden promotes increased self-reliance for treating common health problems like colds, indigestion, and stress. By integrating history into the design and associated interpretive panel, the garden elevates awareness of the significant influence of Christianity and Middle Eastern traditions on European herbology and styles of gardening.

Native Plant Demonstration Gardens

Native plants were used to revegetate a large percentage of the ground disturbed to construct Seminar II. Increasingly, environmental educators promote native plant gardens as a way to reduce water use, eliminate the need for pesticides, provide wildlife habitat, and avoid introducing noxious, invasive weeds. Reference texts on native plants include Link, *Landscaping for Wildlife*; Hitchcock and Cronquist, *Flora of the Pacific Northwest*; and Kruckeberg, *Gardening with Native Plants in the Pacific Northwest.* Native plants are integrated into most of the other teaching gardens, comingled with the non-natives.

Post Glacial Forest

The Post Glacial forest is a recreation of the vegetation that occurred in the region as the Vashon glacier receded from its Olympia terminus. The plant palette is based on palynology data from pollen core samples taken from wetlands in the Puget Sound area (Hansen 1947, Petersen et al. 1983, and Whitlock 1992). The late glacial period samples from which the plant palette was primarily derived range in age from 13,500 to 11,400 years old. We took some artistic license given design and availability limitations. Thus the result is to some degree a historical fiction. However, the Post Glacial Forest does contain species known from the pollen record by 8,000 years ago. During construction of Seminar Building II, the construction company saved erratic boulders left on site by the last retreating glacier. Additional erratics were brought in to complete the landscape as designed. Lodgepole pine dominate with a small grove of aspen. Sedges dominate the understory.

Prairie Roof Garden

Modeling after our native prairies in South Puget Sound, this garden teaches about these cultural landscapes as important oases of species diversity including many threatened species (Leopold and Boyd 1999). This garden was installed in 2003 when the library roof was renovated. In tandem with learning about this unique local ecosystem, students in the programs Natural History and Restoring Landscapes donated community service hours to this garden in 2006 and 2007. Rod Gilbert of the Washington Native Plant Society wrote the text for two interpretive panels. Contract student Randi Smith created original illustrations and did the graphic arts work for these panels. Greener grad Daeg Byrne of The Nature Conservancy has donated many hours, pounds of rare seed, and hundreds of native plants to this effort.

Primitive Plant Garden

This garden supports the study of plant evolution from spore bearing species that appear earliest in the fossil record to the more recently evolved flowering plants. Modeled after a similar garden in Strybing Arboretum in San Francisco's Golden Gate Park, visitors can view spore bearing plants (moss, club moss, and ferns), gymnosperms (cycads and conifers), and primitive flowering plants (anemones and hellebores). Cycads are represented by a public art piece by Greener grad Deborah Mersky. Along with pollinators, the piece portrays the multiflagellate sperm of cycads, a primitive character. In the future we hope to establish a small grove of monkey puzzle trees to help students imagine the Jurrasic and Triassic landscapes with dinosaurs cohabitating. Refer to Raven et al. 2005 and Stewart and Rothwell (1993), for more information on plant evolution.

Rain Roof Gardens

On the top of the Seminar II building, roof top gardens reduce the impact of the buildings by mitigating the increase in impervious surface created by the new construction. They were planted with species designed to be low maintenance due to low water needs and, in some cases, the ability to self-propagate. Landscape architects designed these gardens using existing European prototypes. Although most of the gardens are not visible, several can be viewed easily.

Waterwise Pollinator Garden

Students in the Picturing Plants program of 2002/2003 designed this garden. They removed ivy to prepare the site, propagated plants, installed signs, planted plants and illustrated the associated interpretive panel. They planted with species that attract butterflies, hummingbirds, and bees. Referencing one of their seminar texts, Buchmann and Nabhan's *Forgotten Pollinators*, they crafted the text for the interpretive panel, which educates about the excessive use of pesticides in backyard gardens and how that impacts pollinators. It also points out the ecological significance of reduced rates of pollination. Robert Michael Pyle's book *The Butterflies of Cascadia* provides useful information on nectar and caterpillar host plants. The *Western Garden Book* lists plants attractive to butterflies and hummingbirds (Brenzel, pp. 116-121).

Students designed a phase II of this garden which was approved by the CLUC in 2003. It is hoped that this can be installed in the future along with the public art trail through it that provides wheelchair access.

Future Work

In the future we hope to finish several teaching gardens including the Bruce Miller Memorial Garden, the Deer Garden and phase II of the Waterwise Pollinator Garden. We plan to add interpretive panels for the Basket Garden, Deer Garden, Longhouse Ethnobotanical Garden, Native Plant Demonstration Gardens, Primitive Plant Garden and Lawns. We hope to remove a few of the underused lawns and more of the ivy in the core of campus. Edible landscaping in the core of campus would be a tasteful addition, such as fruit trees planted against south facing concrete walls. The Student Health Center has requested a small medicinal herb garden in the core of campus. Based on surveys, there is widespread interest in the creation of a low maintenance labyrinth. More comfortable seating and public art in the gardens would be lovely.

Students are currently working to link the arboretum to the existing trail system that extends beyond the campus core. Interpretive nature trails are being developed on the trail to the organic farm and on two of the beach trails. Community members seeking to add new gardens or garden features, such as benches or public art, are encouraged to discuss their plans with Facilities first to determine whether the addition can be maintained with existing resources. For final approval, plans must be drafted and presented to the Campus Land Use Committee. For additional resources and updates, visit www.evergreen.edu/teachinggardens.

Acknowledgements

First, without the ongoing support of the Facilities staff at The Evergreen State College, this arboretum plan would never have come to fruition. Special thanks to Mark Kormondy, A'hoi Mench, Paul Smith, Andy Wear, and Bob Worley. I am grateful to Michel George for inviting me to write an arboretum plan. Al Wiedemann facilitated development of this plan through his early documentation of the trees and shrubs that were originally planted in the core of the campus. Marja Eloheimo, a leader in the creation and maintenance of the Longhouse Ethnobotanical Garden, supported my efforts to add additional teaching gardens to the core of campus. Art Kruckeberg and Estella Leopold, both emeritus faculty from the University of Washington, consulted on the Post Glacial Forest. Lucia Harrison supported our mutual students in Picturing Plants in their work to design gardens and illustrate signs.

Since completion of the arboretum plan in 2002, many students have contributed to its successful implementation. Ben Helmes updated the basemap of the plantings, and he designed and supervised installation of the Basket Garden. Katie Day designed both a

teaching gardens brochure and the library kiosk directory sign. Megan Muhic designed the directory for the Organic Farm. The following students designed interpretive panels: Anna Baldy, Roussa Cassel, Abigail Groskopf, Rebecca Sheedy and Randi Smith. Rose (Sara) Swan developed detailed plans for a labyrinth and compiled an excellent PowerPoint presentation on it for the CLUC. EcoDesign students contributed bench and tool shed designs. Aaron Hartwell created our webpage. As facilities employees, students Ben Helmes and Karin Thorpe maintained the new gardens in the first couple of years. As the first Teaching Gardens Coordinator Katie Scherrer has organized multiple community service workdays. Heather Kropp is working on a Medicine Forest Trail proposal. A warm thanks goes to the many Evergreen students too numerous to name who completed community serve work on arboretum workdays.

Many community members and organizations have contributed as well. Tikva Breuer from the City of Olympia's Water Resources Program funded the Waterwise Pollinator Garden with a grant. Bob Findlay, retired Landscape Architecture professor from Iowa State University and local Master Gardener, volunteered many hours to work with the students in the Teaching Gardens program in fall 2004. Greener grad Daeg Byrne of The Nature Conservancy has donated hundreds of native prairie plants and many pounds of prairie seeds. Greener grad Erica Guttman of Native Plant Salvage has donated hundreds of rescued plants from development sites. Greener grad Nikki McClure donated a design for a fund raising T-shirt. The Washington Department of Transportation donated plants. Erica Baker and Breanna Trygg of Pacific Education Institute and Thomas De Boer and Apuroop Dasari of Capitol High School all donated hours and plants to the Prairie Roof Garden. Deborah Humphery donated funds for the Medicinal Herb Garden interpretive panel.

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Appendix A. Plant Species By Garden Including Suggested Additions

The following is a list of the plants currently in various teaching gardens. Species that would be nice to add are in bold. Note that the deer garden has not been installed so the listed plants for that garden are suggestions. The plants listed are appropriate for our climatic zone. However, selection of a plant should be customized to each planting site dependent on sun or shade and soil conditions. See Brenzel, Kathleen Norris (ed.). 2001. Western Garden Book. Sunset Publishing Corporation. Menlo Park, CA.

Teaching Garden	*Common Name*	*Scientific Name*
Basket Garden	vine maple	*Acer circinatum*
	five-finger fern	***Adiantum pedatum***
	slough sedge	*Carex obnupta*
	Alaska cedar	*Chamaecyparis nootkatensis*
	red-osier dogwood	*Cornus stolonifera*
	beaked hazelnut	***Corylus cornuta***
	ocean spray	*Holodiscus discolor*
	rush	*Juncus effusus*
	Oregon-grape	*Mahonia nervosa*
	Oregon-grape	*Mahonia repens*
	mock-orange	*Philadelphus lewisii*
	Pacific ninebark	*Physocarpus capitatus*
	Sitka spruce	*Picea sitchensis*
	bitter cherry	*Prunus emarginata*
	cascara sagrada	*Rhamnus purshiana*
	Arctic willow	***Salix arctica***
	Scouler's willow	*Salix scouleriana*
	cattail	*Typha latifolia*
	bear-grass	***Xerophyllum tenax***
Deer Garden	fir	*Abies*
(possible choices)	vine maple	*Acer circinatum*
	Japanese maple	*Acer palmatum*
	yarrow	*Achillea millefolium*
	woolly yarrow	*Achillea tomentosa*
	California buckeye	*Aesculus californica*
	lily-of-the-nile	*Agapanthus*
	agave	*Agave*
	carpet bugle	*Ajuga reptans*
	columbine	*Aquilegia*
	arctostaphylos	*Arctostaphylos*
	sea thrift	*Armeria maritima*
	artemisia	*Artemisia*
	aster	*Aster*
	astilbe	*Astilbe*
	barberry	*Berberis*
	spice bush	*Calycanthus occidentalis*

	sedge	*Carex*
Teaching Garden	***Common Name***	***Scientific Name***
Deer Garden (continued)	bush anemone	*Carpenteria californica*
	ceanothus	*Ceanothus*
	redbud	*Cercis occidentalis*
	flowering quince	*Chaenomeles*
	rock rose	*Cistus*
	cypress	*Cupressus*
	dahlia	*Dahlia*
	bleeding heart	*Dicentra*
	foxglove	*Digitalis*
	echinacea	*Echinacea purpurea*
	heather	*Erica*
	fleabane	*Erigeron*
	escallonia	*Escallonia*
	California poppy	*Eschscholzia californica*
	eucalyptus	*Eucalyptus*
	common blue fescue	*Festuca glauca*
	beach strawberry	*Fragaria chiloensis*
	salal	*Gaultheria shallon*
	hellebore	*Helleborus*
	toyon	*Heteromeles arbutifolia*
	juniper	*Juniperus*
	bay	*Laurus nobilis*
	lavender	*Lavandula*
	mahonia	*Mahonia*
	wax myrtle	*Myrica californica*
	heavenly bamboo	*Nandina domestica*
	daffodil	*Narcissus*
	poppy	*Papaver*
	black bamboo	*Phyllostachys nigra*
	spruce	*Picea*
	pine	*Pinus*
	cinquefoil	*Potentilla*
	rhododendron	*Rhododendron* spp. (except azaleas)
	currants, gooseberries	*Ribes*
	matilija poppy	*Romneya coulteri*
	rosemary	*Rosmarinus officinalis*
	sage	*Salvia*
	santolina	*Santolina*
	sweetbox	*Sarcococca*
	coast redwood	*Sequoia sempervirens*
	blue-eyed grass	*Sisyrinchium*
	spiraea	*Spiraea*
	lamb's ears	*Stachys byzantina*
	snowberry	*Symphoricarpos albus*

	lilac	*Syringa*
Teaching Garden	***Common Name***	***Scientific Name***
Deer Garden (continued)	rhododendron	*Rhododendron spp. (except azaleas)*
	rhododendron	*Rhododendron edgeworthii*
	rhododendron	*Rhododendron yakusimanum*
	thyme	*Thymus*
	clover	*Trifolium*
	California bay	*Umbellularia californica*
	evergreen huckleberry	*Vaccinium ovatum*
	ferns	various species
	iris	various species
	ornamental grasses	various species
	California fuchsia	*Zauschneria californica*
Laurasian Landscape	vine maple	*Acer circinatum*
	Japanese maple	***Acer palmatum***
	Norway maple	*Acer platanoides*
	red maple	*Acer rubrum*
	sugar maple	***Acer saccharinum***
	kinnick kinnick	***Arctostaphylos uva-ursi***
	alder	***Alnus alnobetula***
	madrone	*Arbutus menziesii*
	strawberry tree	*Arbutus unedo*
	wild ginger	***Asarum caudatum***
	wild ginger	***Asarum splendens***
	bunchberry	*Cornus canadensis*
	Eastern dogwood	*Cornus florida*
	kousa dogwood	*Cornus kousa*
	conelian cherry	***Cornus mas***
	Pacific dogwood	*Cornus nuttallii*
	red-osier dogwood	***Cornus stolonifera***
	fringed bleeding heart	*Dicentra eximia*
	western bleeding heart	*Dicentra formosa*
	Japanese bleeding hearts	***Dicentra spectabilis***
	giant fawn-lily	*Erythronium oregonum*
	woods strawberry	*Fragaria vesca*
	wintergreen	*Gaultheria procumbens*
	salal	*Gaultheria shallon*
	Japanese witch hazel	***Hamamelis japonica***
	Chinese witch hazel	***Hamamelis mollis***
	common witch hazel	***Hamamelis virginiana***
	creeping St. Johnswort	*Hypericum calycinum*
	tanoak	***Lithocarpus densiflorus***
	tall Oregon grape	*Mahonia aquifolium*
	leatherleaf mahonia	***Mahonia bealei***
	longleaf mahonia	*Mahonia nervosa*

	Allegheny spurge	***Pachysandra procumbens***
Teaching Garden	***Common Name***	***Scientific Name***
Laurasian Landscape	Japanese spurge	*Pachysandra terminalis*
(continued)	beach pine	*Pinus contorta*
	Japanese red pine	*Pinus densiflora*
	Swiss mountain pine	*Pinus mugo mughus*
	Austrain black pine	*Pinus nigra*
	sword fern	*Polystichum munitum*
	Japanese lace fern	***Polystichum polyblepharum***
	soft shield fern	*Polystichum setiferum*
	Korean rock fern	***Polystichum tsus-simense***
	flowering cherry	*Prunus cerasifera atropurpurea*
	bitter cherry	*Prunus emarginata*
	flowering cherry	*Prunus sargentii*
	flowering cherry	*Prunus serrulata* 'Shirotae'
	choke cherry	*Prunus virginiana*
	big cone Douglas-fir	***Pseudotsuga macrocarpa***
	Western white oak	*Quercus garryana*
	Western azalea	*Rhododendron occidentale*
	rhododendron	***Rhododendron edgeworthii***
	rhododendron	***Rhododendron yakusimanum***
	blue elderberry	***Sambucus cerulea***
	black elderberry	***Sambucus nigra***
	red elderberry	*Sambucus racemosa*
	wake robin	*Trillium grandiflorum*
	wake robin	*Trillium ovatum*
	wake robin	*Trillium sessile*
	red huckleberry	*Vaccinium parvifolium*
	highbrush cranberry	***Viburnum edule***
	European cranberry bush	***Viburnum opulus***
	Japanese snowball	***Viburnum plicatum***
	viburnum	***Viburnum X bodnantense***
	English violet	*Viola odorata*
	evergreen violet	***Viola sempervirens***
Native Plant	vine maple	*Acer circinatum*
Demonstration Garden	yarrow	*Achillea millefolium*
	Service berry	*Amelanchier alnifolia*
	Pearly everlasting	*Anaphalis margaritacea*
	Red columbine	*Aquilegia formosa*
	madrone	*Arbutus menziesii*
	kinnick kinnick	*Arctostaphylos uva-ursi*
	Goat's beard	*Aruncus dioicus*
	wild ginger	*Asarum caudatum*
	deer fern	*Blechnum spicant*
	camas	*Camassia quamash*

	slough sedge	*Carex obnupta*
Teaching Garden	***Common Name***	***Scientific Name***
Native Plant	Pacific dogwood	*Cornus nuttallii*
Demonstration Garden	red-osier dogwood	*Cornus stolonifera* 'Isanti'
(continued)	California hazelnut	*Corylus cornuta*
	Pacific bleeding hearts	*Dicentra formosa*
	Oregon sunshine	*Eriophyllum lanatum*
	wild strawberry	***Fragaria virginiana***
	Salal	*Gaultheria shallon*
	large-leaved avens	*Geum macrophyllum*
	ocean spray	*Holodiscus discolor*
	Oregon iris	*Iris tenax*
	rush	*Juncus effusus*
	twin berry	*Lonicera involucrata*
	Oregon-grape	*Mahonia nervosa*
	Oregon-grape	*Mahonia repens*
	false lily of the valley	***Maianthemum dilatatum***
	Indian-plum	*Oemleria cerasiformis*
	mock-orange	*Philadelphus lewisii*
	Pacific ninebark	*Physocarpus capitatus*
	Sword fern	*Polystichum munitum*
	Douglas-fir	*Pseudotsuga menziesii*
	cascara sagrada	*Rhamnus purshiana*
	Pacific rhododendron	*Rhododendron macrophyllum*
	pink flowering currant	*Ribes sanguineum*
	Bald-hip rose	*Rosa gymnocarpa*
	Cluster rose	*Rosa pisocarpa*
	thimbleberry	*Rubus parviflorus*
	Salmonberry	*Rubus spectabilis*
	trailing blackberry	*Rubus ursinus*
	false Solomon's seal	*Smilacina racemosa*
	Hardhack	*Spiraea douglasii*
	snowberry	*Symphoricarpos albus*
	fringe cups	*Tellima grandiflora*
	Western red cedar	*Thuja plicata*
	star flower	*Trientalis latifolia*
	Evergreen huckleberry	*Vaccinium ovatum*
	red huckleberry	*Vaccinium parvifolium*
	stream violet	*Viola glabella*
Post-Glacial Forest	silver fir	*Abies amabilis*
	red alder	*Alnus rubra*
	avalanche alder	***Alnus sinuata***
	paper birch	*Betula papyrifera*
	slough sedge	*Carex obnupta*
	Pacific dogwood	*Cornus nuttallii*

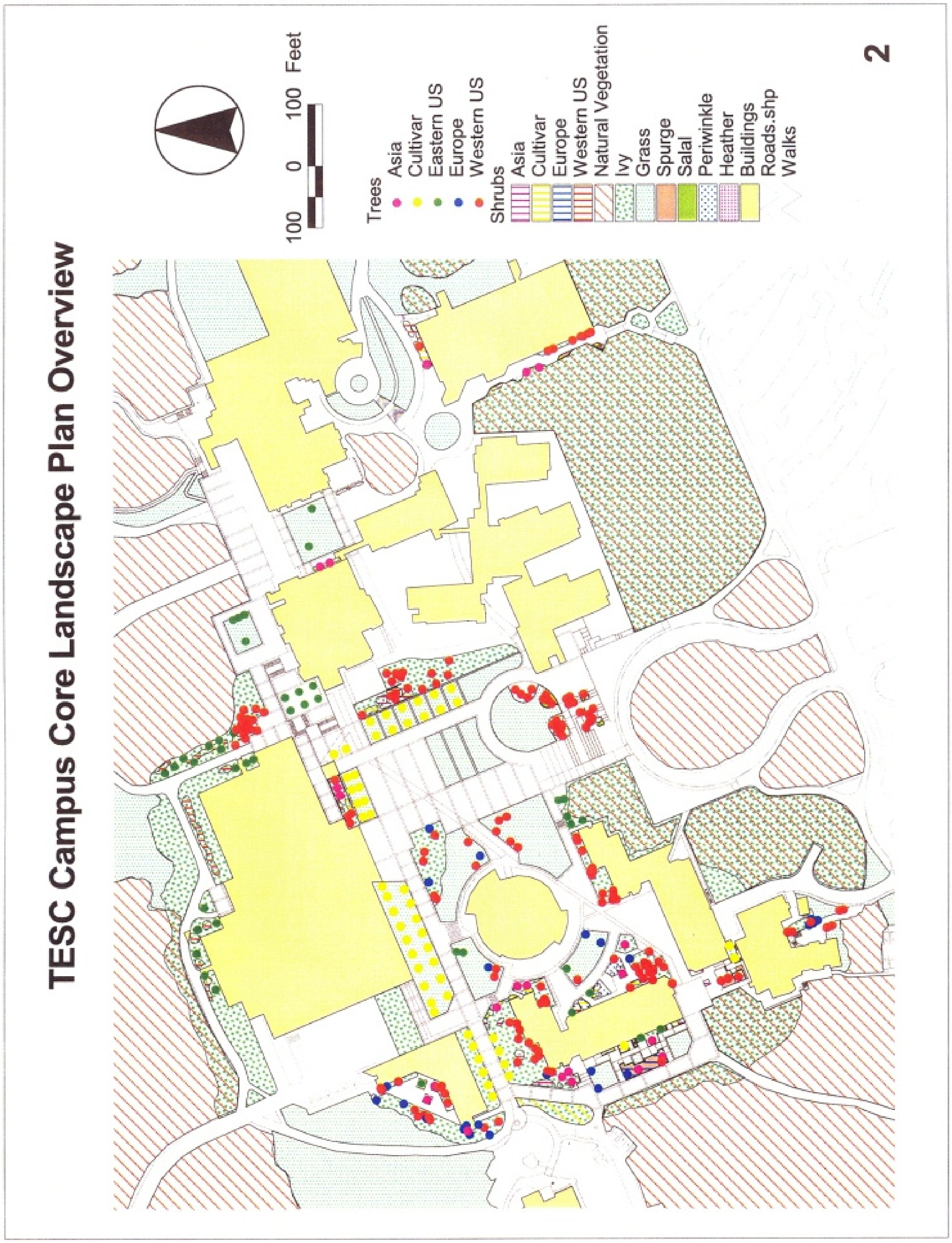
	red-osier dogwood	*Cornus stolonifera*
Teaching Garden	***Common Name***	***Scientific Name***
Post-Glacial Forest	Idaho fescue	*Festuca idahoensis*
(continued)	Rocky Mountain juniper	*Juniperus scopulorum*
	lodgepole pine	*Pinus contorta*
	Western white pine	*Pinus monticola*
	quaking aspen	*Populus tremuloides*
	Gambel oak	***Quercus gambelii***
	dwarf arctic willow	*Salix purpurea*
	snowberry	*Symphoricarpos albus*
	Western red cedar	*Thuja plicata*
	mountain hemlock	*Tsuga mertensiana*
Prairie Roof Garden	yarrow	*Achillea millefolium*
	kinnikinnick	*Arctostaphylos uva-ursi*
	sea-pink	*Armeria maritima*
	common camas	*Camassia quamash*
	bluebell	*Campanula rotundifolia*
	paintbrush	*Castilleja hispida*
	California oatgrass	*Danthonia californica*
	showy fleabane	*Erigeron speciosus*
	woolly sunflower	*Eriophyllum lanatum*
	Idaho fescue	*Festuca idahoensis*
	wild strawberry	*Fragaria vesca*
	broadpetal strawberry	*Fragaria virginiana*
	Oregon iris	*Iris tenax*
	nine-leaved lomatium, biscuitroot	*Lomatium triternatum*
	barestem lomatium	*Lomatium nudicaule*
	common lomatium	*Lomatium utriculatum*
	lupine	*Lupinus lepidus*
	lupine	*Lupinus rivularis*
	wood rush	*Luzula campestris*
	microseris	*Microseris laciniatus*
	plectritis	*Plectritis congesta*
	Western buttercup	*Ranunculus occidentalis*
	catchfly	*Silene douglassii*
	golden rod	*Solidago missouriensis*
	golden rod	*Solidago spathulatum*
	early blue violet	*Viola adunca* var. *adunca*
Primitive Plant	Japanese anemone	*Anemone* X *hybrida*
	Oregon anemone	***Anemone oregana***
	Monkey puzzle tree	***Araucaria araucana***
	wild ginger	*Asarum caudatum*
	lady fern	*Athyrium filix-femina*
	deer fern	*Blechnum spicant*

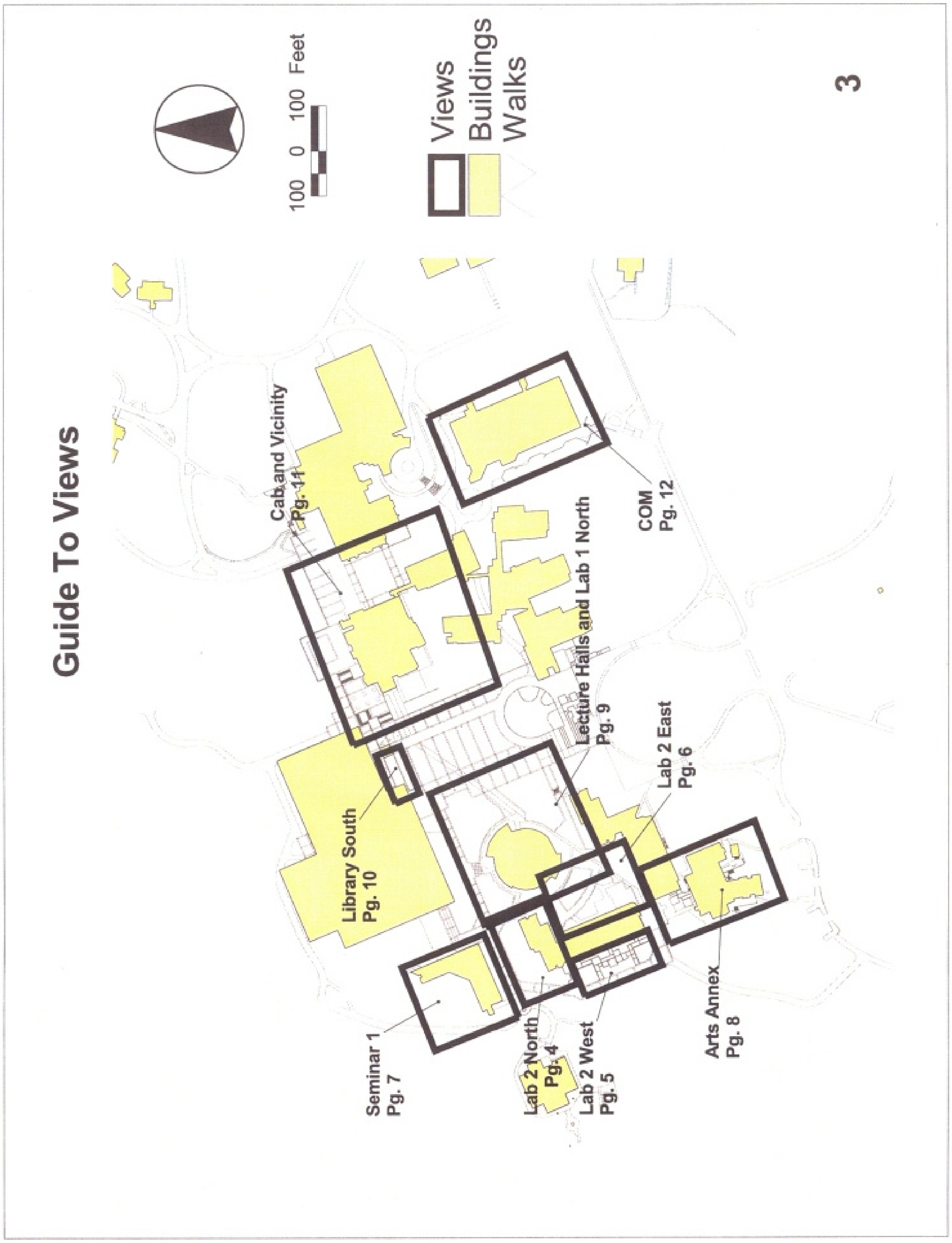
	spice bush	***Calycanthus occidentalis***
Teaching Garden	***Common Name***	***Scientific Name***
Primitive Plant (continued)	male fern	*Dryopteris filix-mas*
	ginkgo	*Ginkgo biloba*
	hellebore	*Helleborus foetidus*
	juniper	***Juniperus***
	sword fern	*Polystichum munitum*
	giant redwood	***Sequoiadendron giganteum***
	coast redwood	***Sequoia sempervirens***
	golden spikemoss	***Selaginella kraussiana* 'Aurea'**
	rainbow spikemoss	***Selaginella uncinata***
	Pacific yew	*Taxus brevifolia*
	California yew	***Torreya californica***
	western hemlock	*Tsuga heterophylla*
	Western red cedar	*Thuja plicata*
Rain Roof Garden	carpet bugle	*Ajuga reptans*
	kinnikinnick	*Arctostaphylos uva-ursi*
	blue fescue	*Festuca glauca*
	beach strawberry	*Fragaria chiloensis*
	wintergreen	*Gaultheria procumbens*
	Oregon sorrel	*Oxalis oregana*
	sedum	*Sedum*
	thyme	*Thymus*
Waterwise Pollinator	yarrow	*Achillea* 'Moonshine'
Garden	Norway maple	*Acer platanoides*
	giant ornamental onion	*Allium giganteum*
	serviceberry	***Amelanchier alnifolia***
	wild columbine	*Aquilegia formosa*
	madrone	*Arbutus menziesii*
	kinnikinnick	*Arctostaphylos uva-ursi*
	sea thrift	*Armeria maritima*
	Douglas' aster	*Aster subspicatus*
	kale	*Brassica*
	Oregon grape	*Mahonia aquifolium*
	camas	*Camassia leichtlinii*
	wild lilac	*Ceanothus* .
	rock rose	*Cistus*
	Pacific bleeding heart	*Dicentra formosa*
	echinacea	***Echinacea purpurea***
	globe thistle	*Echinops sphaerocephalus*.
	giant fawn-lily	*Erythronium oregonum*
	sea holly	*Eryngium amethystinum*
	escallonia	*Escallonia langleyensis* 'Pride of Donard'
	California poppy	*Eschscholzia californica*

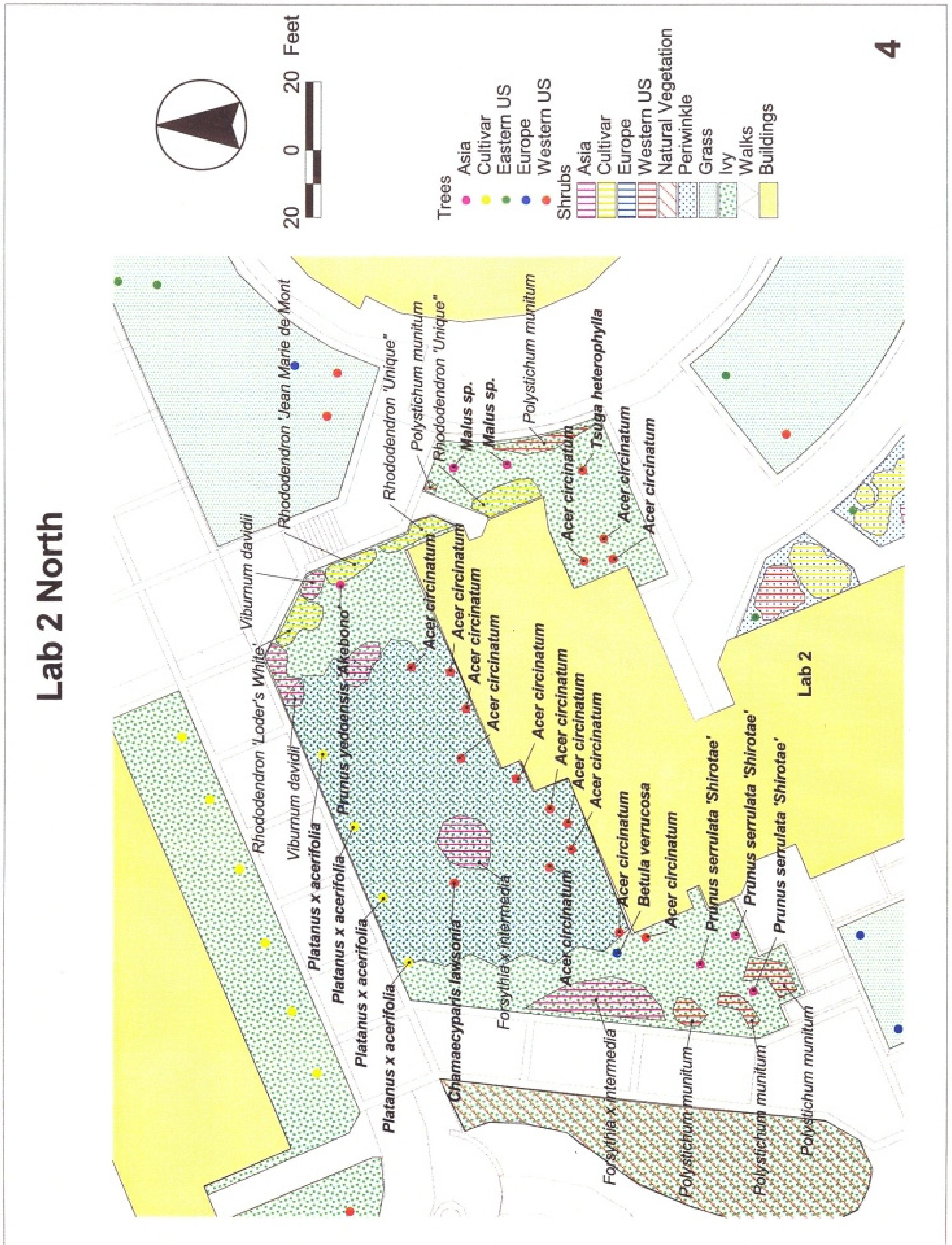
	coast strawberry	*Fragaria chiloensis*
Teaching Garden	***Common Name***	***Scientific Name***
Waterwise Pollinator	wood strawberry	*Fragaria vesca*
Garden (continued)	salal	*Gaultheria shallon*
	daylily	*Hemerocallis*
	bearded iris	*Iris*
	wild iris	*Iris tenax*
	lavender	*Lavendula angustifolia*
	twinberry	***Lonicera involucrata***
	lupine	*Lupinus polyphyllus*
	apple	*Malus*
	false lily-of-the-valley	***Maianthemum dilatatum***
	grape hyacinth	*Muscari comosum* 'Plumosum'
	Indian plum	*Oemleria cerasiformis*
	Oregon sorrel	*Oxalis oregana*
	penstemon	*Penstemon*
	mock orange	***Philadelphus lewisii***
	cinquefoil	*Potentilla fruticosa*
	Western rhododendron	*Rhododendron occidentale*
	golden currant	*Ribes aureum*
	pink flowering currant	*Ribes sanguineum* 'King Edward VII'
	baldhip rose	*Rosa gymnocarpa*
	wild rose	*Rosa woodsii*
	rosemary	*Rosmarinus officinalis*
	salmonberry	*Rubus spectabilis*
	gloriosa daisy	*Rudbeckia fulgida*
	blue elderberry	***Sambucus cerulea***
	red elderberry	*Sambucus racemosa*
	sedum Autumn Joy	*Sedum* 'Autumn Joy'
	hardhack	*Spiraea densiflora*
	snowberry	*Symphoricarpos albus*
	evergreen huckleberry	*Vaccinium ovatum*
	blue muffin arrowwood viburnum	*Viburnum dentatum* 'Blue muffin'
	sweet violet	*Viola odorata*
	evergreen violet	***Viola sempervirens***
	weigela	*Weigela* 'Wine and Roses'

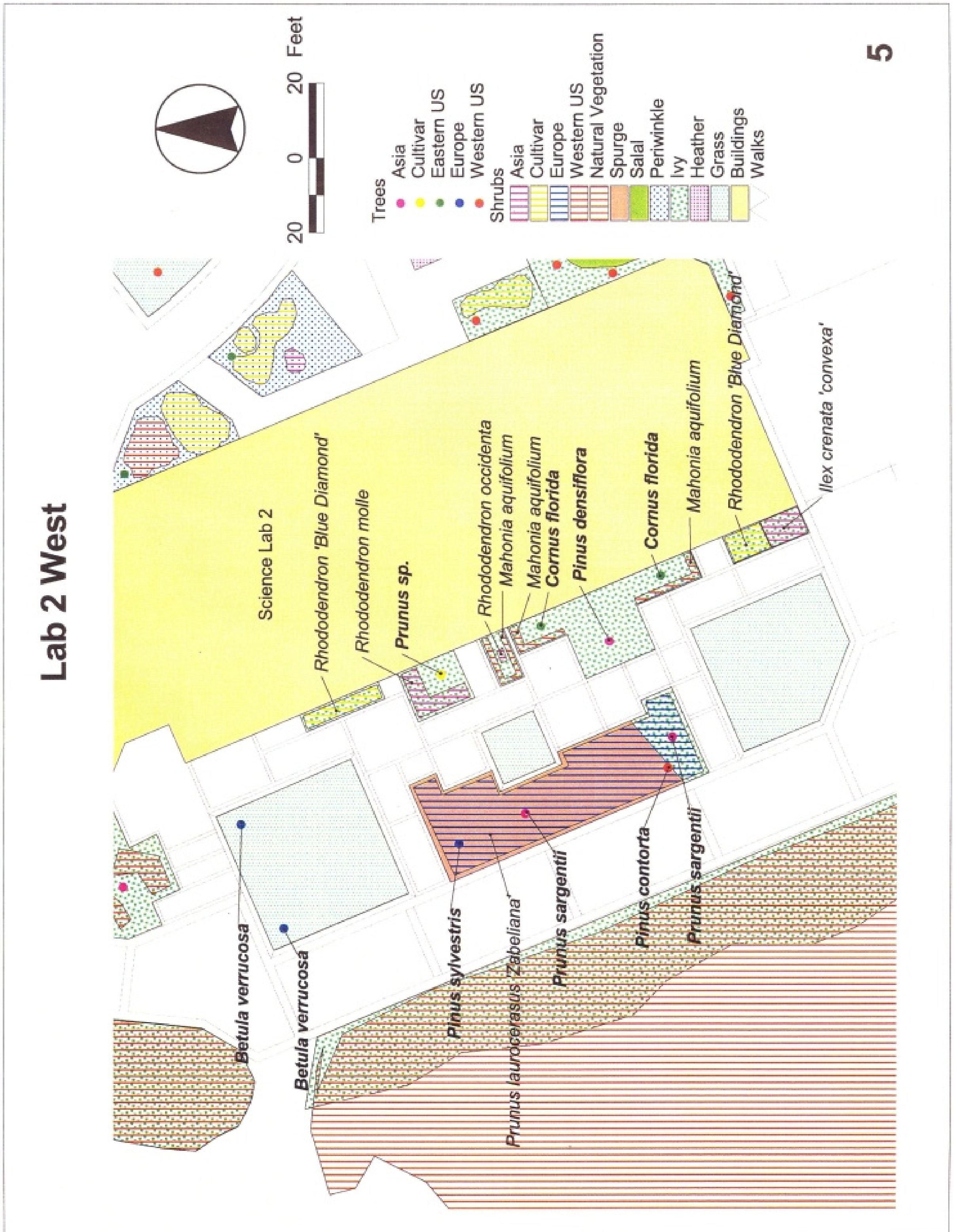
Appendix B:

Baseline Maps Compiled by Ben Helmes in 2002

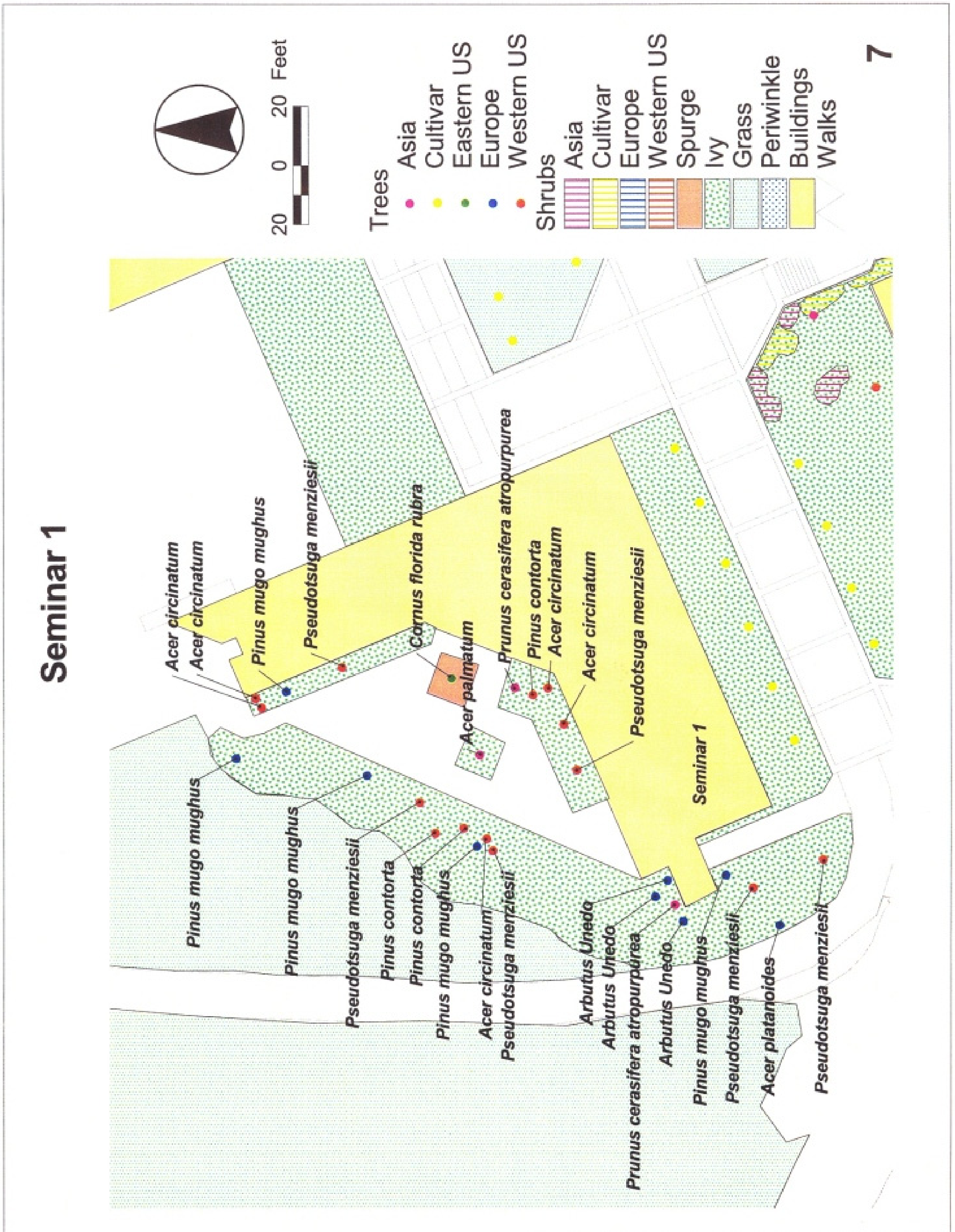

TESC Campus Core Landscape Plan Overview
100 0 100 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Ivy
Grass
Spurge
Salal
Periwinkle
Heather
Buildings
Roads.shp
Walks
2

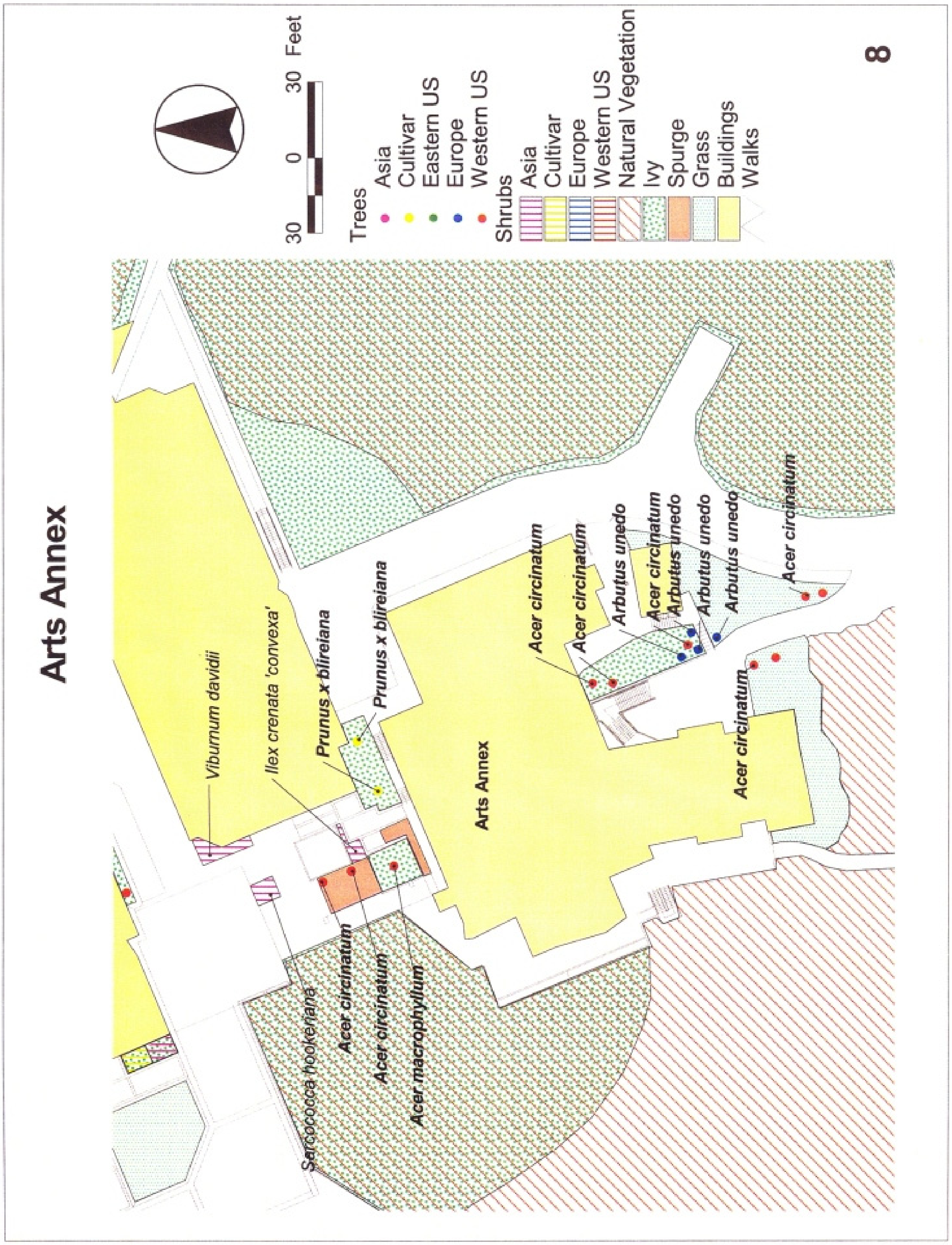

Guide To Views
100 0 100 Feet
Views
Buildings
Walks
3
Cab and Vicinity
Pg. 11
Library South
Pg. 10
Lecture Halls and Lab 1 North
Pg. 9
COM
Pg. 12
Lab 2 East
Pg. 6
Seminar 1
Pg. 7
Lab 2 North
Pg. 4
Lab 2 West
Pg. 5
Arts Annex
Pg. 8

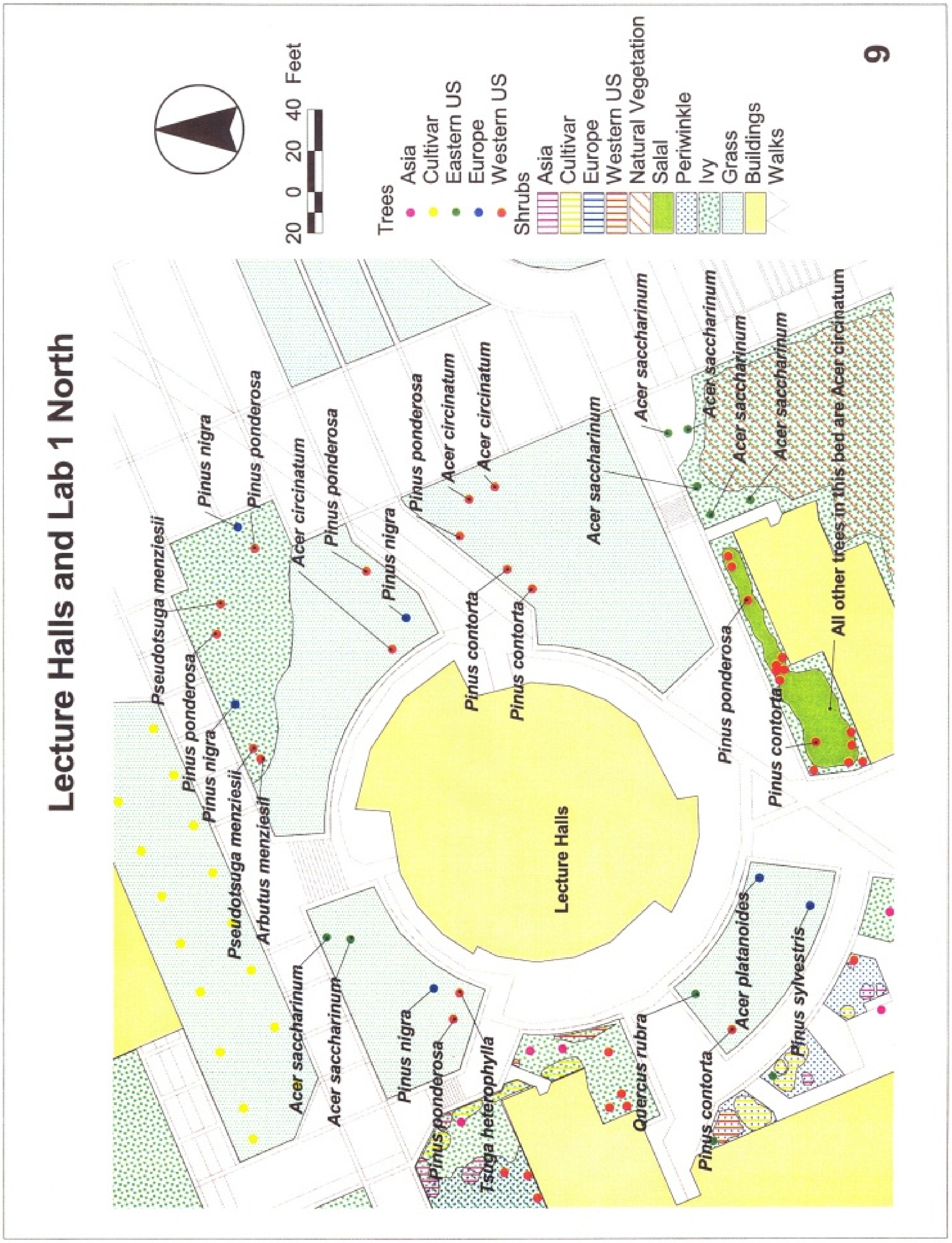

Lab 2 North
4
20 0 20 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Periwinkle
Grass
Ivy
Walks
Buildings
Lab 2
Rhododendron 'Jean Marie de Mont'
Rhododendron 'Unique'
Polystichum munitum
Rhododendron "Unique"
Malus sp.
Malus sp.
Polystichum munitum
Tsuga heterophylla
Acer circinatum
Viburnum davidii
Rhododendron 'Loder's White'
Viburnum davidii
Prunus yedoensis Akebono
Platanus x acerifolia
Chamaecyparis lawsonia
Forsythia x intermedia
Betula verrucosa
Prunus serrulata 'Shirotae'
Polystichum munitum


Lab 2 West
Science Lab 2
0 20 Feet
20
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Spurge
Salal
Periwinkle
Ivy
Heather
Grass
Buildings
Walks
5
Rhododendron 'Blue Diamond'
Rhododendron molle
Prunus sp.
Rhododendron occidenta
Mahonia aquifolium
Mahonia aquifolium
Cornus florida
Pinus densiflora
Cornus florida
Mahonia aquifolium
Rhododendron 'Blue Diamond'
Rhododendron 'Blue Diamond'
Ilex crenata 'convexa'
Betula verrucosa
Betula verrucosa
Pinus sylvestris
Prunus laurocerasus 'Zabeliana'
Prunus sargentii
Pinus contorta
Prunus sargentii


Lab 2 East
6
20 0 20 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Spurge
Salal
Periwinkle
Ivy
Heather
Grass
Buildings
Walks
Lab 2
Quercus rubra
Pinus contorta
Acer platanoides
Pinus sylvestris
Rhododendron 'Loder's White'
Rhododendron 'Jean Marie de Mont
Magnolia stellata 'Waterlily'
Vaccinium parvifolium
Pinus contorta
Pinus densiflora
Acer platanoides
All tree within salal boundary are
Pseudotsuga menziesii
Cornus nutalii
Acer circinatum
Acer circinatum
Acer circinatum
Cornus florida
Mahonia aquifolium
Rhododendron 'Loder's White
Quercus rubra
Magnolia stellata 'Waterlily
Rhododendron schlippenbachi
Styrax japonicus
Acer circinatum
Rhododendron 'Jean Marie de Mont
Acer circinatum
Acer circinatum
Acer circinatum
Acer circinatum

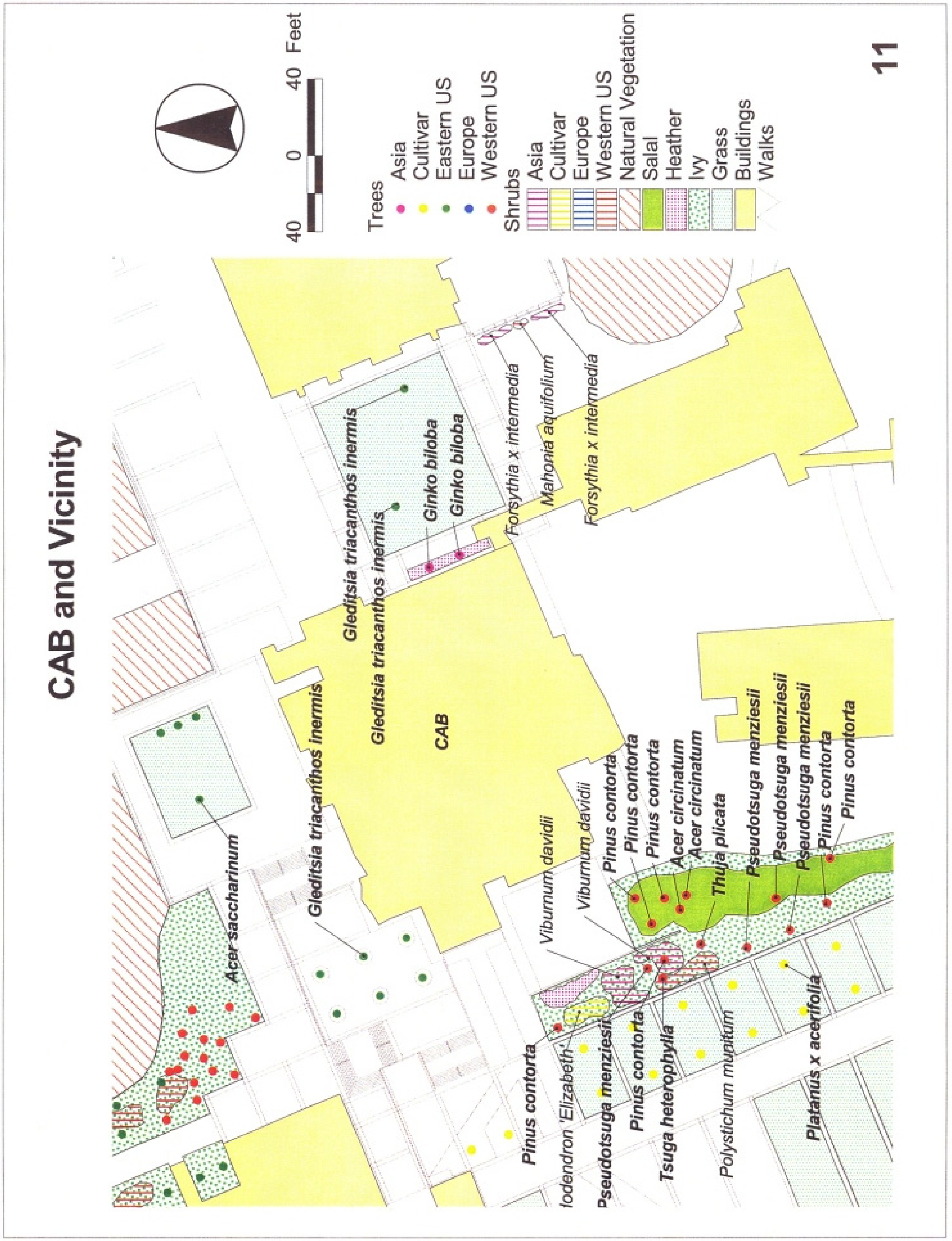

Seminar 1
Feet
20 0 20
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Spurge
Ivy
Grass
Periwinkle
Buildings
Walks
7
Acer circinatum
Acer circinatum
Pinus mugo mughus
Pseudotsuga menziesii
Cornus florida rubra
Acer palmatum
Prunus cerasifera atropurpurea
Pinus contorta
Acer circinatum
Acer circinatum
Pseudotsuga menziesii
Seminar 1
Pinus mugo mughus
Pinus mugo mughus
Pseudotsuga menziesii
Pinus contorta
Pinus contorta
Pinus mugo mughus
Acer circinatum
Pseudotsuga menziesii
Arbutus Unedo
Arbutus Unedo
Prunus cerasifera atropurpurea
Arbutus Unedo
Pinus mugo mughus
Pseudotsuga menziesii
Acer platanoides
Pseudotsuga menziesii

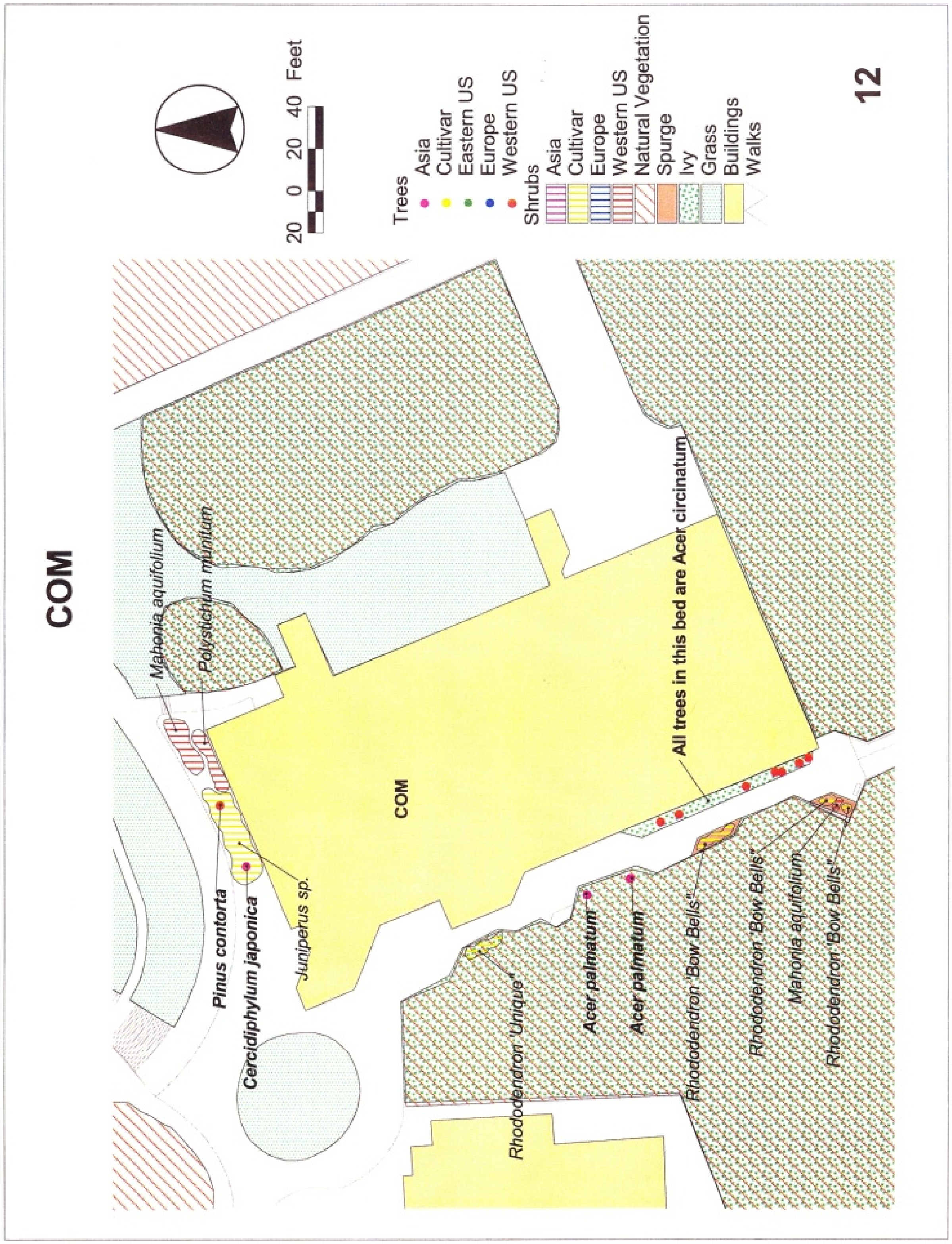

Arts Annex
8
30 0 30 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Ivy
Spurge
Grass
Buildings
Walks
Viburnum davidii
Ilex crenata 'convexa'
Prunus x blireiana
Prunus x blireiana
Arts Annex
Acer circinatum
Acer circinatum
Arbutus unedo
Acer circinatum
Arbutus unedo
Arbutus unedo
Arbutus unedo
Acer circinatum
Acer circinatum
Sarcococca hookeriana
Acer circinatum
Acer circinatum
Acer macrophyllum



Lecture Halls and Lab 1 North
9
20 0 20 40 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Salal
Periwinkle
Ivy
Grass
Buildings
Walks
Lecture Halls
Pseudotsuga menziesii
Pinus nigra
Pinus ponderosa
Acer circinatum
Arbutus menziesii
Acer saccharinum
Acer platanoides
Pinus sylvestris
Pinus contorta
Quercus rubra
Tsuga heterophylla
All other trees in this bed are Acer circinatum


Library South
10
0
10
20
Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Ivy
Grass
Buildings
Walks
Library
Clock Tower
Viburnum davidii
Pinus contorta
Prunus sargentii
Prunus sargentii
Skimmia japonica
Rhododendron 'Elizabeth'
Platanus x acerifolia
Polystichum munitum
Polystichum munitum
Tsuga heterophylla
Viburnum davidii
Pinus Ponderosa
Pinus Ponderosa
Polystichum munitum
Platanus x acerifolia


CAB and Vicinity
11
40 0 40 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Salal
Heather
Ivy
Grass
Buildings
Walks
CAB
Acer saccharinum
Gleditsia triacanthos inermis
Gleditsia triacanthos inermis
Gleditsia triacanthos inermis
Gleditsia triacanthos inermis
Ginko biloba
Ginko biloba
Forsythia x intermedia
Mahonia aquifolium
Forsythia x intermedia
Viburnum davidii
Viburnum davidii
Pinus contorta
Pinus contorta
Pinus contorta
Acer circinatum
Acer circinatum
Thuja plicata
Pseudotsuga menziesii
Pseudotsuga menziesii
Pseudotsuga menziesii
Pinus contorta
Pinus contorta
Pinus contorta
Pseudotsuga menziesii
Pinus contorta
Tsuga heterophylla
Polystichum munitum
Platanus x acerifolia


COM
12
20 0 20 40 Feet
Trees
Asia
Cultivar
Eastern US
Europe
Western US
Shrubs
Asia
Cultivar
Europe
Western US
Natural Vegetation
Spurge
Ivy
Grass
Buildings
Walks
Mahonia aquifolium
Polystichum munitum
All trees in this bed are Acer circinatum
COM
Pinus contorta
Cercidiphylum japonica
Juniperus sp.
Rhododendron 'Unique'
Acer palmatum
Acer palmatum
Rhododendron 'Bow Bells'
Rhododendron 'Bow Bells'
Mahonia aquifolium
Rhododendron 'Bow Bells'

P

CAMPUS MEETING NOTES

(February-October 2007)

A compilation of notes taken by project members during information gathering sessions, one-on-one meetings, eco-charrettes, open forums and workshops at he Evergreen State College.

MEETING NOTES: Meeting With the Following Individuals

MEETING DATE: February 26, 2007

BY: Paddy Tillett

THOSE PRESENT:

TESC	ZGF
Rob Knapp	Don Miles
Crystal Passi (student representative)	Tim Williams
Bob Leverick	Paddy Tillett
Paul Smith	

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1. The importance of place-making was raised this morning in the context of sustainability.
2. A full time study package called Sustainable Design Materials is a current program that ends in three weeks. A Community Design-Community Action program will begin in the spring. It is hoped that some of the students in that program will be actively involved in the master plan process. The purpose today is to identify the process, and how engagement might occur.
3. Sustainability is addressed in many different ways on this campus, buried in other things that go on.
4. Beginning today, the consultant team is focusing on draft goals and objectives, based on what we have just heard from senior Administration. The team will continue to listen carefully throughout the process, although the draft schedule suggests discrete tasks. The schedule has been timed to the academic year, and avoids evaluation week at the end of each term.
5. The initial campus workshops occur during a busy time, and there is concern about the probable level of participation. We have heard that more short sessions may be preferred. A number of subjects would be raised with the whole group or break-out groups in each workshop.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of receipt of the notes.

MEETING NOTES: Senior Administration

MEETING DATE: February 26, 2007

BY: Paddy Tillett

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1. It is important to be clear about the role of students: there must be a clear interpretation of issues to students. A promotional campaign to involve students at some stage would be important. As a first step, we would like to communicate the dates of meetings on the Intranet. We also want to identify credit involvement.
2. We must also connect formally with student government. There is interest in promoting this throughout the student body. The staff coordinator is Andy or Bill.
3. March 13th is a Board meeting in Tacoma. A one hour work session is scheduled; the purpose will be for the design team to listen to what board members concerns might be.
4. It should be made clear that there is a framework within which this master plan will fit. Looking at the 2005 update of the master plan, five land use goals have been extracted as a starting point. Are these goals and the 15 procedures the appropriate place for the master plan team to begin?
5. One thing that has changed is a much stronger emphasis on green design and sustainability, so the language needs to be updated in that respect.
6. Within the goals, there should be something that addresses the relative suitability for development of different parts of the campus. The emphasis has been around the footprints of existing buildings. In the future, we might look to acquisition of new land.
7. Is technology adequately captured by the goals? An aspect of this also affects the quality of student life on campus. This master plan should go further out than current conditions. Thinking about the campus in relation to nearby communities is important – the campus is less of an island than it was ten years ago.
8. Preservation of the ecological quality of the campus means many different things to different people.
9. Take the five goals and rephrase them in more current language. The old master plan dwelt on things not yet built; conditions have changed.
10. Several objectives and projections were stated in the 2005 master plan update, e.g. an increase of enrollment to 5,000. Are these numbers still valid? Yes, but in preparation for times to follow, consider what will be needed if a greater enrollment is eventually achieved.
11. The College will continue to have a presence in Tacoma – perhaps substantially larger than the 225 students there now.
12. What is the role of the sustainability task force in the process? They will be active participants. The purposes of being a teaching and learning institution require a constant reminder of the context of the campus and the connections between environment and learning.
13. Evolving demographics suggest that we may become more of a resident campus rather than the predominantly commuter campus. 950 of 4200 students now resident. There is also a growth in student housing off campus but nearby.
14. The sustainability group is quantifying the carbon contribution of the campus. The role of the campus in climate change will require immersion in this issue so that realistic objectives can be incorporated in the master plan.
15. Financial Futures investigation looked at nearby development, including a waterfront retreat community. Downtown opportunities were also examined. These resources will be available to the master plan team.
16. Imagining our thousand acres as becoming a special reserve within an urbanizing region. How

could we make this reserve a resource to nearby schools and other elements of the community? It may be decades before the value of this is generally recognized, but we need to define what it can be now.

17. Involvement of students in an entrepreneurial way in the relationship between the campus and its neighbors opens interesting possibilities. What is the best balance that you envisage between the campus and development around its periphery? A conference on campus would be one way to discover this.
18. There may be some competing values where students are concerned. A survey indicated that they lack services near campus. Access to alternative food, laundry and entertainment were all cited, underlining a sense of isolation from necessary services.
19. All of our questions will not be answered by the master plan, but we should understand what the County anticipates for land around the campus: residential and commercial development – how much and how soon? These will affect what we need to do on campus.
20. Community encroachment and the use of recreational facilities affect the quality of the environment for students.
21. There are specialist consultants on the team to deal with the technicalities of transportation planning, engineering etc.
22. Safety and security work has changed. How we think about these in the context of the College. Lighting, especially in the back of the campus, needs to be looked at.
23. Policies and Procedures for Land Use will be presented another time.
24. Student life should govern what we do and what we build, not the other way around.
25. The goal for on-campus living is stated as an expansion from 25% to 33% residency. Does that still seem the right range? We need to look at state demographics to understand likely growth. Currently, we are accepting more freshmen, there are shifts throughout the state from two-year to four-year schools. High school direct expectations remain high. A third of students on campus in addition to those living near the campus should be assumed. This provides something to plan towards, even if designated housing sites are not developed in the near term.
26. Modernization and replacement of buildings should be considered. Long term life-cycle costs should be part of the analysis of existing buildings and should influence the decision to remodel or replace a building.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of receipt of the notes.

MEETING NOTES: Campus Landscape

MEETING DATE: March 11, 2007

BY: David Grant/ZGF
Crystal Passi/TESC Student

THOSE PRESENT:

TESC	ZGF
Frederica Bowcutt, Faculty	David Grant
Crystal Passi, Student	

DISTRIBUTION: Frederica Bowcutt
Crystal Passi

Topics discussed included the following:

1. Dave and Crystal met with Frederica to discuss the campus landscape and reserve and envision how they can be further developed to assist in teaching, reinforce the school's identity, and honor the original design vision for the campus. We also discussed the challenges of managing and maintaining such a landscape.
2. The following items were discussed:
   - Frederica authored the Arboretum Plan, which was adopted in September of 2002. The Plan is a 10 year plan (2002-2012) that creates teaching gardens around campus. The teaching gardens are used as teaching aids for classes and as interpretive gardens for the community at large. The plan has been very successful, and all but one of the recommended gardens have been installed. Only the Deer Garden has not been installed.
   - The Teaching Gardens have increased the demand on the landscape maintenance crews. The gardens were created in a span of only a few years, and Grounds has had difficulty responding. The addition of formal landscape to the campus creates additional maintenance work that is compounded by the fact that herbicides and pesticides cannot be used. Frederica is sympathetic to the overloaded Grounds team and would like to look at ways to utilize volunteers:
     - Master Gardeners – Master Gardeners are required to maintain their title by performing a certain amount of service hours every year. This may be a source of volunteer maintenance time.
     - Master Naturalists – At the national level there is also a Master Naturalist program. This program does not currently exist in Washington State, but an Evergreen student is trying to establish it here, and this may be another opportunity to bring outside volunteerism onto campus.
     - Student work study – A number of students are already employed on a part time basis by Grounds to perform maintenance in the landscape. Additional student involvement may be possible through a student work study program.
     - Prison labor - There may be an opportunity to utilize prison labor for maintenance tasks on parts of the campus.
   - One of the challenges in using volunteer labor for maintenance is that currently all of the landscape maintenance equipment is stored at the Facilities yard for use by the Grounds crews. In order for volunteer labor to be a practical tools will need to be available in the campus Core. Frederica proposes an equipment shed that will be used to house items such as tools, hoses, and carts. The shed could be located inconspicuously to the northwest of the Seminar I building at the base of the ivy-covered slope. A volunteer labor force will also need access to water, so quick couplers should be provided in beds where volunteers will be working.

- Frederica would like to broaden the exposure of the campus landscape so that it is used as an educational resource by local schools. Educational amenities include the Teaching Gardens, the Reserve, and the Organic Farm. Frederica would also like to develop a medicine trail that could be used for educational purposes.
- Landscape initiatives are often easy to fund through donor recognition programs.
- The establishment of an advisory committee (e.g. "Friends of Evergreen Reserve) may help to generate community interest and volunteerism.
- A number of people have expressed a desire to see more color on campus, and public art may help in that regard. Frederica advises that any discussion of locating art on campus should include faculty member Bob Leverich. We should also consider the appropriateness of art pieces in the reserve. Care should be taken to inventory students work and to retain pieces that my have value as public art on campus.
- Campus landscape standards need to be developed. Currently there is disagreement on campus over appropriate mulch type and depth.
- The campus currently does not have a water feature on it, but has several areas of grade-change that would accommodate one nicely, and a water feature might help to further animate the campus Core.
- We discussed the possible creation of a policy whereby any capital improvement project would be required to undergo a review process at key points in its inception and design to identify educational opportunities and advise on its landscape. Reviewers would include campus staff, faculty, and students.
- A number of practices exist on campus that are in conflict with the recommendations made in the existing master plan. A process needs to be established for enforcing the recommendations of documents such as the master plan so that individuals do not have to champion the recommendations.
- A policy addressing the number and appropriateness of memorials on campus needs to be established.
- A land use committee would be valuable so that different parties on campus are not working in isolation from each other. Any policy, practice, or physical improvement to the campus would need to go before this committee so that conflicting initiatives are not at play. An example was given where one party on campus had identified a small plot of land for an educational planting and another party then installed a memorial on this spot, as they were unaware of other plans for the area. Another example was given where a memorial bench was installed in the reserve without approval from anyone.
- We talked at length about using the landscape and reserve as a bridge to the surrounding community. Greater outreach could occur through several measures:
    - Greater web presence – the campus landscape and reserve could have online interpretation, photography, event listings, maps, discussion forums etc.
    - Reserve coordinator – a part time position could be established to coordinate events in the reserve such as school programs, interpretive walks where students and faculty share knowledge with community members, etc. The coordinator could also refer incoming questions about the reserve from the community to students and faculty.
    - Formalize the reserve as a public amenity – this can be done by referencing national forest/national park vernacular (e.g. trailhead stations and signage).
- Cold Canyon Reserve and Jepson Prairie at UC Davis are examples of a successful reserve system at a public academic institution, and should be referenced in our work with the Evergreen reserve.

End of notes

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MEETING NOTES: Board of Trustees

MEETING DATE: March 13, 2007

BY: Don Miles

THOSE PRESENT:

TESC	ZGF
President and Board of Trustees	Don Miles
John Hurley, Vice President, Finance and Administration	
Paul Smith, Facilities Services	
Ken Tabbutt, Academic Dean	

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Topics discussed included the following:

1. John Hurley outlined the purpose, product and schedule for the Master Plan. Paul Smith introduced the Planning Committee and consultant team.
2. Don Miles reviewed the Mission and Goals for the Master Plan. These were based upon the 2005 Update of the 1998 Master Plan and the Strategic Plan with revisions suggested by Senior Administration. There was consensus that these provided a good foundation for the plan.
3. Don Miles reviewed the planning process and schedule emphasizing opportunities for the engagement of students, faculty, staff and community through a number of workshops and meetings. Don Miles described the initiatives being taken to provide student learning opportunities. Opportunities for engagement are planned around the Academic Calendar and standing meeting dates of committees and organizations to encourage participation.
4. The Master Plan will address on and off campus facilities and Don Miles mentioned the important information gathered from meetings earlier in the day with administrators of TESC Tacoma campus and the Reservation Based Program.
5. Comments from the Board of Trustees included the following:
   - The campus Core and Reserve should be a learning experience and open and inviting to the community and adjacent neighborhoods;
   - The campus should be planned to attract outside revenues and donors;
   - Opportunities should be explored for student, faculty and staff housing and neighborhood services on and/or adjacent to campus;
   - Given increasing Cooper Point development, the plan should address personal safety, transportation and sustainability.

End of notes

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MEETING NOTES: Reservation Based/Community Determined Program

MEETING DATE: March 13, 2007

BY: Don Miles

THOSE PRESENT:

TESC	ZGF
Jeff Antonelis-Lapp, Director and Member of the Faculty, Reservation Based/Community Determined Program Paul Smith, Facilities Services Ken Tabbutt, Academic Dean	Don Miles

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Topics discussed included the following:

1. The Reservation Based/Community Determined Program began in 1989. Classes are only for 3rd and 4th year students with Grays Harbor Community College Bridge program preparing the majority of the students.
2. Currently six tribes participate in the program (Makah, Muckleshoot, Nisqually, Port Gamble S'Kallam, Quinault and Skokomish). Classes are taught at the following locations: Quinault, Muckleshoot, Nisqually, Lower Elway, Port Gamble and Skokomish. Four Saturdays per quarter all the students in the program (TESC/Grays Harbor interface) attend classes in the Longhouse on TESC main campus. Four classrooms (20 students each) are used in the Longhouse at this time. The kitchen at the Longhouse is used extensively during Saturday classes and traditional tribal meals are served to students and faculty.
3. Currently there are 80 students in the program (35 Evergreen and 45 Grays Harbor)
4. In the future the program is expected to double in size. At that time, the Longhouse might be used 8 Saturdays per quarter.
5. The Tribal Councils are actively involved in overseeing the program and classes taught and have a "government to government" agreement with TESC on the respective responsibilities for the program.
6. The Longhouse and adjacent Ethnobotanical Garden on TESC main campus are central to the program. The design and construction timbers used in the Longhouse were donated by the tribes. There is a cleansing ceremony at the Longhouse at beginning of each Saturday program. A separate graduation ceremony for the program with active participation of alumni of the program occurs each year at the Longhouse.
7. A $1.8 million expansion is planned for the Longhouse. The intent is to build a companion building at the site to provide additional classrooms, a studio for an artist-in-residence, and lodging accommodations ("bunk house") for the artist and students traveling long distances to Saturday classes.
8. The program has taken an active role in TESC Diversity Lecture Series.

End of notes

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MEETING NOTES:	Facilities Staff Meeting
MEETING DATE:	March 14, 2007
BY:	Dan Edleson-Stien
DISTRIBUTION:	Paul Smith for distribution to the College as deemed appropriate

DTF	*Adititional Housing?*
(Wheelchair) Accessibility	*Lack in Student Housing, Laundry, can't access 2 story building*
Philosophical Plans, 1998, 2005	*Underpinnings but this one is more concrete and physical. Moving beyond ADA access.*
Dorms	*Too expensive at $7-800 for quarter, lack of accessibility, loss of independence*
Off Campus	*Older kids move off*
Quiet & Drug Free	*Better taken care of by users*
Housing Distribution	*Change nature if housing more divided up, loss of community feel*
Dorm, Apartment, House	*ABCD, Soup, Mods (Mods can sometimes by 2 to a room however)*
Housing Sem II Style?	*Clustered multi-level housing that is divided yet physically connected*
Wheelchair	*Ramps are too steep to use for most*
Dream Idea Food	*Grocery Store/Co-Op- Real Food, Not Outrageously Priced. Location at HCC. Turning corner store into grocery store. Closed Off. Sandwich Shop closed. School sponsored shuttle to co-op? Support Local Farms*

Section for recycling not enough tucked in. Need more ordered recycling setup.

Kids are messy, take for granted year-end cleanup.

Kitchens in A building a Health Concern. Create a charge. Community Kitchens for the ABCD dorms.

Things falling apart/30 years of overflowing toilets. Everything Needs a general Update.

New stuff not as ugly as old stuff. D was renovated this summer.

Cynical about recycling, couldn't be more centralized.

No more composting in dorms. Health code, lack of funding.

Walk at night, no connection with residents. Disconnect can be refreshing. Performances but rarely, library.

Café late at night in dorm area. (Could money from CAB designated for student run café be transferred to location somewhere else on campus?) (Could this be done for the overall funds for CAB as it seems that it is too many activities located on just upper campus with lack of attention to lower campus?)

Lack of HCC as center. Field & Red Square. Even CAB. Frisbee Golf anyone?

Subterranean previously sandwich shop late night on campus.

Groceries- Widely Embraced, pricing structure, pre sale, Food Co-Op.

End of notes.

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MEETING NOTES: Sustainability Task Force

MEETING DATE: March 14, 2007

BY: Dan Edleson-Stien

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The Best Group of People on Campus	*Put together DTF for strategic plan, have a website w sustainability plan. Now non-disappearing-permanent committee.*
John???	*Grad Student, Head of Task Force*
Original Plan	*Eight chapters, curriculum of sustainability, most relevant surrounding facilities, land stewardship, facilitates bio-diversity, increases connection with nature.*
Carbon Neutral	*Neutral and Zero Waste Campus by 2020. Treat Land as an eco-system. More than just pro-active design. Evergreen as leaders through actual practice and visual clues. Classroom as educational building. Didactic campus.*
Manlo?, Sweden	*Amenities are the garbage. Make everything transparent (so a seven year old can understand).*
Going Back to the Architecture of the First Peoples	*Speak with Ken Kramarz at Camp Tawonga.*
County Zoning Issues	*TESC: Island in Suburban Sprawl. Suburban Ghetto, Need link between city and campus.*
Carbon Budget	*Biggest Use is travel to and from campus, faculty travel – rethink transport. (City redo the dark stretch between campus and city for night bike riders or at least add night lighting?)*
Central Plant	*Replacement for boilers*
Sense of Identity	*Sense of Definition*
Wildlife Habitat Corridors?	

Gateways	*Defining Edge of Environmental Stewardship. Telling the story.*
Learning the community better	*Urbanized Campus*
Long term ecological studies	*Looking backward in time as well*
Thinking about larger context	*Sense of place is different in different quadrants around campus. Not every piece of land has the same significance.*
Fundamental Tensions	*Clean vs Natural*
Sust Technologies	*Photovoltaic, Groundwater Heating.*
Food Visibility	*Organic Farm as Teaching Tool* *Expanding Acreage* *Herb Gardens, Teaching Gardens* *Big Greenhouse on Red Square?*
Red Square	*Stage of Campus as defined by Native American Program*
Goal of increasing number of students on campus	*(The best way to do this is to create enjoyable housing on or nearby campus that does not feel like it is on-campus housing)*
Faculty and Staff Housing	*Affordable Housing, Co-Housing for Faculty & Staff near campus*
Maintenance	*Facility Location. Modernizing facilities for what?*
Increasing Health	*Students, Teachers, IT'S A BIG GERM FEST.*
Design Guidelines in Master plan	*"TESC will be a laboratory for sustainability."*
Campus Transportation	*Will Terr at Boulder*
ASHE	*Looks at Campus Sustainability Nationwide*
Charrette with planners from ZGF firms	*I definitely want to be a part of this.*

End of notes.

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MEETING NOTES: Open Student Meeting

MEETING DATE: March 14, 2007

BY: Dan Edleson-Stien

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Architecture: More in the forest, woodwork, open space. Like Sem II.

Other Building's feel too clustered. Greater Openness. More Natural Vegetation.

(Could you create more architecture like Sem II through renovations that create open designs and plant trees in between?)

Charles Loosen – Member of the Student group "Take Back The CAB". Working to get student control of the $15 million being paid by students for CAB renovation, in past student funds have been misappropriated by administration. Legal right of students to have control. Control would allow them to hire architects and maintain control throughout entire process. charlessloosen@msn.com, geoduckunion@gmail.com. Questions regarding state versus student fees as well.

More Hangout Space.
Sem II café great spot to get away.
HCC doesn't work.
CAB doesn't work.
More Couches.
Place to step out of the flow.

Scheduling. 8AM versus 10AM. Divided between specializations.

Campus Planned Anticipating 12,000 Students.

End of notes.

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MEETING NOTES:	Community Meeting
MEETING DATE:	March 14, 2007
BY:	Dan Edleson-Stien
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Non-Care

Laboratory for Natural Studies

Care

Blending of Classes & Housing increase density of Mods

Does New Master Plan Replace Old One?

Language Similar to Old Master Plan in regards to preserve/reserve. More tight/graphics. Architects create documents that translate for the state.

Gateways

Central Park, NYC

this look is more rustic and in tune with forest than Evergreen's Current Plastic Signage on Trails.

Resistant to Taming The Forest

Habitat corridors, maritime connections that extend beyond the boundaries. Not a general thinning of the forest to become a park.

Eminent Domain vs. Board of Trustees

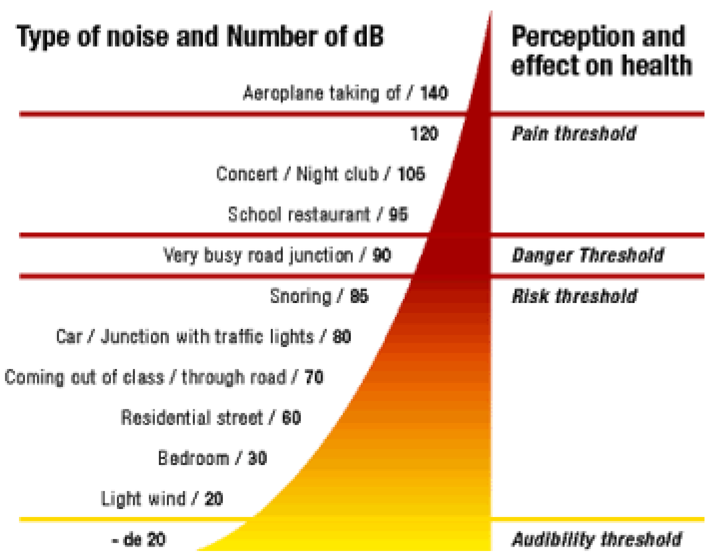
Interpretive Center In the Woods — *Environmental Field Lab. April 4th, Robyn Herring.*

Faculty names — *Everyone has their own names for forested parts of the Campus. (Use studies to design similar to Islandwood ala Designing with Nature by Ian McHarg)*

Organic Farm vs Eco-Researchers

Facilities Substandard
Housing Not Market Value. Treat on campus students as renters. Inefficient Maintenance. Shotty Construction Quality

Good to keep upper and lower separate as students come of age and party a lot, need the separation. Attracting students to continue to live on campus: Differences in lifestyles gradients.



(Some like it loud. Some not so much. How can you cater to all through overall design?)

Need Dining at Lower Campus (it seems like dinner would make sense on lower campus, lunch at upper, breakfast either or. Weekends lower) Eating is a social event.

Dealing with food, flexible food options. Scope, Flexibility, Adequate Kitchen Facilities.

Landscaping, Desired paths

Jose Gomez
Faculty have very little opportunity to interact outside their disciplines. Faculty lounge or Meeting Place. A place where faculty would go after class to unwind. All faculty can come together to have a social interaction. Comfortable. Similar concept to high school faculty lounge. Vital to get to know each other. Interdisciplinary place with interdisciplinary education needs this place. Mailboxes and coffee shop are different dynamic. Centrally located by SemII. CAB Renovation? Planning Units- Holding meetings in the place defeats the purpose; if things are scheduled people can't rely on being able to unwind there. Need this as transition from founding faculty to new hires.

(This campus is socially fragmented. Everyone wants a comfortable place to lounge. At every and all times.)

End of notes.

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MEETING NOTES: Campus Tour of Organic Farm

MEETING DATE: March 15, 2007

BY: Dan Edleson-Stien

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Two Trails	*24 acre farm*
Vision	*Shift Allotment*
Commitment to Food System Is Essential	*Megan Pardi (Aramark Sustainability Intern?)*
Connection to Capital Forest	
Worms	*2 70 ft long worm bins needed for food compost from campus*
Chicken Barn	*Needs Replacement*
Balance Education vs. Production	
Warren Wilson	*Excellent Case Study*
Aramark wants wholesale	*Economically more beneficial to sell from stand*
Culinary Kitchen Needs	*12 ranges needed for class*
Farm Size	*Currently not enough acreage to rotate. Clubroot is a problem. 3 acres. Need 24 acres.*
Evergreen Brand Furniture (I know the perfect place to do a test run).	*Milkao? wants to do a collaborative line.*

Ideas Abound…

Permaculture Garden	*Support from faculty. Issues comes from students working hard for two years, coming in, then leaving and new students coming in and changing everything. Melissa set to take over as guiding faculty.*
Composting	*Should be a facilities issue. Farm doesn't have the capabilities to process Aramark Food. Drifwood House sited as opportune location.*
Ralph Nirone?	

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MEETING NOTES: Parking

MEETING DATE: March 15, 2007

BY: Dan Edleson-Stien

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- Redid Parking 2 years ago. 7,700 dollars per space for "green parking". Still used asphalt.
- B lot has not been at capacity other than graduation & Super Saturday.
- Parking Booth is a shack, first thing people see on entry. (THIS IS A GATEWAY FOR PEOPLE COMING TO CAMPUS VIA CAR)
- Pay as you leave parking is very much hoped for.
- 16 spaces currently metered at 30 cents/hr. Short Term Parking Option. Expand over to C-Lot. No longer 1 hr passes.
- 2nd Cheapest Parking in Nation. Renting space, how can you give it away?
- Talk of raising rates, see document Chief Ed Sorger Has compiled on this. (raising rates as incentive for carpooling, problem of raising too much comes from people living in rural areas without public transport access).
- Cheap parking line paint has caused confusion as to where spots are.
- Dan Duncan hakamadan@gmail.com – Student working on incentives to carpool. Old carpool program paid for decals. No more incentive to not use car. Worked before.
- Mr. Duncan is looking into purchasing a Biodiesel Bus to provide continued service throughout the night to campus. (This is one way to make students living on campus feel like they are living off campus).
- All night Bus funding- has administration taken notice?
- Possibility of Working with Intercity transit. School already has good rapport. Possibility of one driver doing the 48 route and the 41 route alternatively every hour through out the night.
- (Adds revenue to business, etc. May encourage late night food places off campus to stay open longer.)
- Dirt farm was originally where longhouse was supposed to be. What is it good for? More parking.

End of notes.

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MEETING NOTES: Student Housing Tour

MEETING DATE: March 15, 2007

BY: Dan Edleson-Stien

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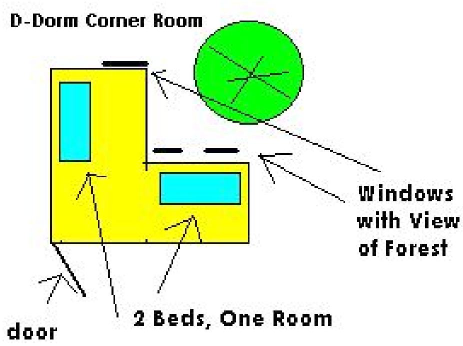
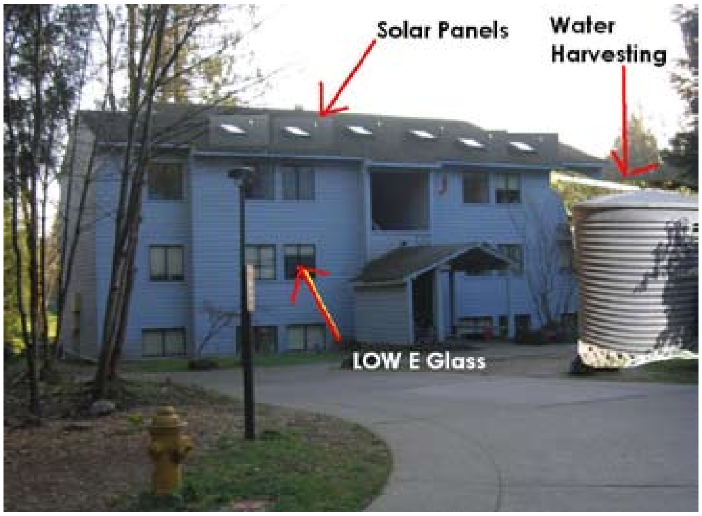
Dorms (Newly Renovated D Dorm)



Good shape, hardwood floors are nice.

The Soup (Sustainability Housing, J Dorm?)
Students Like Size. Maybe More Kitchen Space for six people. Sustainable Housing, make it more sustainable in the built environment. Currently is architecturally the same as other Soup housing.



Cheap and effective solutions to give a visual distinction to Sustainability Housing

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MEETING NOTES: Community Meeting

MEETING DATE: March 15, 2007

BY: Dan Edleson-Stien

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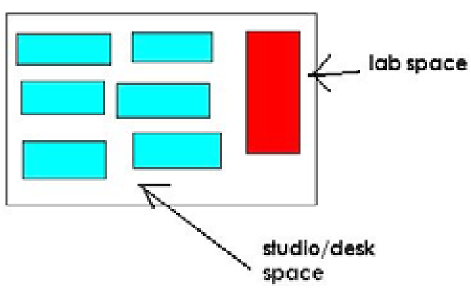
IT- Data comes in on 20k system. Fiber in every building, floors vary from building to building. Goal is to get fiber on every floor. Main distribution frame- in library. IDF (Intermediate Distribution Frame) in every building.

Improve Air Conditioning. Redundant Cooling System. Running off new Sem I generator. 1 gig hertz rate w vs. 10 gig hertz speed. CAT6 vs CAT6A. 90 Meter distance from switch to outlet is very necessary.

Art Programs are competing for studio space. Part time vs full time.



The classroom lab: a unique space needed for classes in the Evergreen Style.

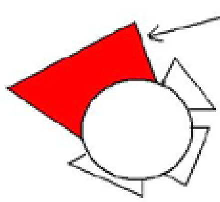
Lack of study space. Cozy nooks, range of options. Need a range of options.
Informal meeting spaces
Maintaining Flexibility.
CLUC & How it operates, is it effective?
Heritage Preservation – Historic Preservation. Keep the brutalism. Campus community is too close to architecture to recognize it's historical content.

(Historic Renovation that is modern while paying homage to where it came from. The Mill Musuem in Minneapolis is an excellent example of this.)

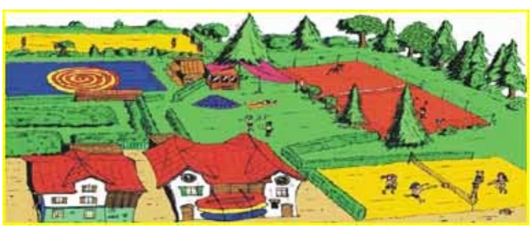
Red square vacant – address space, intensify energy.

Idea – Open sheltered space on red square

Something for students to lounge on coming off the round building -



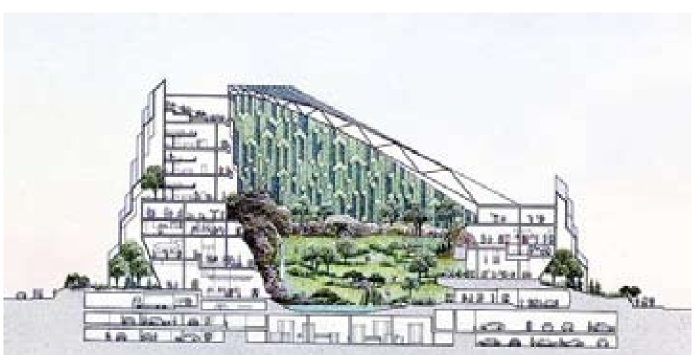
(realistically it's not enough. Students need something more in the central area and something to be dedicated strictly to sheltered lounging. Examples: Funny Farm in Sweden, or clubs/bars in Seattle with outdoor space)



(Funny Farm, Interlaken, Sweden)

On graduation red square is very filled.

(Challenging the outdoor/indoors. Play with it. A theme for Evergreen.)



Emilio Ambasz

A lot more freshman. Acceptance rate of 98%. Slowdown of transfers.
Boom of freshman. Not expected.
Maintaining Density of the Core. Connection to the past.

Co-Op tied into the neighborhood.
Transit options. Mobility- There was not a Chapter on mobility in other Master plans.

Bus Stops are plain and unorganized.

Coffee Shop?

Immediate Stewardship of the land viewed from the outside.

(Already intensive green roofs. Utilize. Several acres of farm on campus. Could this minimize deforestation? 10 acres of roof on upper campus. Have teachers become responsible.)

Russ Fox - Land Use Planner

Carolyn Dobbs – Other Land use Planner on Faculty.

Comprehensive Land Use Plan with Community Development.

1970?- 100 Acre Peace Development purposed. 20 acre commercial, 80 acre housing with 20 units per acre.

Chuck McKinney.

Meyer's corporation.

Long History. Everyone Being Involved in Land Use around the campus.

Supreme Court Hearings around development.

Growth Boundary used to be larger. Utility/water use that was originally connected for planned size of Evergreen gave way to sprawl growth due to lack of use by the college.

Intent of Growth, Land Use- Sustainability Community Center. Co-Housing for teachers. Current doesn't reflect values of school.

Cooper Point Association- Doesn't carry same stature as used to.

Focus on update of county plan coming up soon. Olympia growth area.

How to combat suburban sprawl encircling Evergreen.

(Need to inform architects about Glen & New Glen in relation to campus)

Original Cooper Point Plan was more environmentally integrated, a village.

Working similar values.

Original Campus Master Plan.

Green Design + Affordability = What Evergreen Should be all about

Other thoughts:

Create a distinct separation of upper and lower campus through the architectural aesthetic

Woodsy Home Feeling vs. Institutional Academic Feeling

Night Students as well as majority of other students unheard in the initial meetings. Work to get more student participation. A lot of Greener's are apathetic until after the fact.

Farm House is the aesthetic the HCC should have. Think Cozy Lodge.

The residential part of campus should be modeled after a summer camp, because that is essentially what it is. See Camp Tawonga, specifically their dining hall, as an excellent example of the type of space Greener's need on Campus.

End of notes.

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MEETING NOTES: Campus Meetings

MEETING DATE: April 11, 2007

BY: Jeff Dunn

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C+C (8:30)

- Existing fiber network includes both single mode fiber and multi-mode fiber. Would like to go to all single mode fiber. This will enable both data and media to be delivered through the same infrastructure. The change to single mode will require a gear change and more space. Many of the existing data closets are too small and poorly ventilated.

- Existing PBX (only MDF) is called the machine room which houses the servers and is located in the basement of the library building. This space is adequate for foreseeable growth. Subsequent distribution (IDF) is to data closets on each floor.

- Existing fiber and copper network is supplied through underground tunnel (approx. 8x10) with some conduit between tunnel and buildings. Some locations need to be audited for access and efficiency. An overall cable audit and clean out needs to occur.

- Existing "dark" fiber from PBX to housing is available for future use.

- Existing Comcast fiber supplied to two nodes; the "A" Residence Hall and the Housing Center.

- C+C infrastructure needs to be included in building programming early for all renovation and new construction. This will enable the necessary support system and flexibility as technology and teaching styles evolve.

- Emergency power and UPS need to be provided for infrastructure. Current emergency power in each building for life safety is not adequate to support additional load. Separate cut over switches for each system are required.

- There is an existing campus access control system called Millennium that connects all doors back to one location. There is a large demand for more access control which includes card access for internal doors and audited access on some internal doors.

- The existing video protection infrastructure is in need of an upgrade. This should include both improved video protection as well as motion detection.

- Exposed cable trays are undesirable especially in more secluded or private spaces. Cable delivery system needs to allow for flexibility and offer some level of protection. J-hooks are undesirable.

- Ideally each floor of a building will have a designated IDF room with fiber break outs from these rooms to data/media intensive areas. This room should separate but adjacent to a department or specialized "IDF" if needed for learning purposes. It is anticipated that the need for these specialized areas will continue to develop.

- Centralized as well as more remote locations on campus should be equal in terms of C+C access. This includes both indoor and outdoor areas. An integrated wireless network that allows for indoor repeating.

- The “mediation” of classrooms provides for and interactive / collaborative multi-media experience for both faculty and students. Media and date could be accessed and controlled though laptops with access to separate screens that small groups can gather around.

- Campus wide integration of infrastructure should emphasize informal spaces to allow for more spontaneous and interactive collaboration.

- Connection from the central machine room to off campus needs to be upgraded for future growth.

CRC (9:45)

- The existing track is in need of an upgrade with a rubberized surface. It will be used for both conditioning as well as the track program.

- Lighting the sports fields will increase their usage and enable their ratability.

- There is a desire to have additional parking and drop off access to the sports fields. This will improve access and safety for the arrival and departure of young players and campers as well as emergency access.

- Field 5 area is currently designated for future baseball / softball field(s).

- Fields 1 and 2 are flexible and can be laid out (painted) as needed for different uses.

- Sports camps are a source of revenue. Currently about 60% of the annual budget is provided through revenue with the remainder being provided by student fees and the State.

- Pavilion could be converted into an indoor “sport court” which would increase its usability and rentability.

- There is a need for adequate restroom facilities located near the sports fields.

- CRC would like to see the driftwood house used for alternative activities such as art and weaving.

- There is a desire for designated locker and team rooms near the sports fields. This could be incorporated into a field house.

- There is a need for an improved connection and access between the CRC, the Core campus, the housing community, and off campus users. These improved connections would increase the use of the facilities as well as create an on campus presence as a center for health.

- An increased number of flexible movement would increase use of the facility.

- Smoking shelter locations and effectiveness needs to be reviewed.

Housing Staff (11:15)

- Currently 20% (approximately 800) of students live on campus. With the future desired growth of 5,000 students on campus, the college would like to have 1/3 (approximately 1,700) of all students living on campus.
- As students get older they tend to move off campus. Current percentages of students living on campus include; 80% of 1st yr, 40% of 2nd yr, 20% of 3rd yr, and 10% of 4th yr. It is believed that this is because the core of student life doesn't exist on campus.
- The current ideal housing demographic distribution includes locating Freshman in the A,B,C and D residence halls, senior undergraduates in the "Soup", and students 25 and older in the modular housing.
- There is a current need for an increased amount of higher density housing for younger students (freshman and some sophomores). Ideally this would be in the form of towers like the "A" residence hall. Approximately 5-6 buildings with 90-100 beds each, double occupancy in suites.
- There is a desire to locate additional housing closer to the Core of the campus while maintaining relative proximity to existing housing.
- The existing "Soup" housing is in relatively fair condition and continues to incur maintenance costs in repairs and system upgrades.
- Current revenue sources on campus include a corner store in the HCC as well as conference housing. An improved housing stock and a grocery store would improve revenue for both respectively.
- Currently access to parking near housing is desirable for both the monitoring of vehicles and retrieval of groceries. Improved bus services could alleviate some of this need.
- It is believed that potential classroom space incorporated into and adjacent to housing would be greatly utilized.
- There is a need for a designated retreat center with adequate food service support. Ideally the center could support a banquet of 500 people at round tables. The Pavilion is a potential location for this.
- Housing would like to be more connected to recreational activities including the CRC building, and the natural recreation amenities.
- Current plan to pull housing support services out of the buildings and the central spaces to create new outdoor public space.
- Potential purchase or land trade acquisition of existing private housing Cooper's Glen would provide a good location for new housing.
- An increased amount (some within 2-4 mos.) of private sector housing is being built near campus and will create another draw for students to live off campus.

- Renovation of the modular housing is seen as a future need.

- It is desirable for future housing to include common space and separate study space on every floor with double loaded corridors.

Open Campus Mtg (1:30)

- There is a need for a retreat center (separate but close) for 250-300 faculty and some student programs, with flexible meeting spaces and housing. Locating facility near the water would improve its marketability.

- There is need for a large centralized and enclosed community space and meeting space.

- Allow space for and observatory to be located in an adequate location on campus. Should be designed for a telescope of some scale.

- Maintain connection to relocated OCS currently located in the Geoduck House. Philosophically similar and tied to teaching programs. Ideally would have space on the campus.

- Naming of buildings, fields, and forests is important for sense of identity and community.

- Shelters could be located in a variety of on campus locations for spontaneous individual study and class use. Spaces would be very open and connected to their natural surroundings but provide shelter from the elements.

- Plan should emphasize different senses of place and access between them. A habitable boundary of the campus perimeter is one example of such a place.

- Spaces need to be flexible.

- Integrate art as both object and community.

PUC I (3:15)

- Facilities should be compatible with curriculum

- There is a need for more media spaces with power point capability, film, web access, and document camera. Still want to be able to show slides.

- A faculty lounge is needed in a centralized location that will create community by providing for faculty interaction, planning, and relaxation. This should be separate from any cafeteria spaces but include a galley type kitchen. It should also be a place to bring potential faculty to showcase the university. Like a faculty club. Emeritus faculty could also be included.

- A designated language lab (community or center) would provide a place for the language community to practice and study as individuals and in conversation groups. The room should include about 8-10 computers and individual study carrels for listening and speaking activities. Ideally would be connected to the library (potential for pop-out bay library growth).

Satellite TV connection for international news sources.

- There is a desire to have a visual/physical presence for the humanities. Like language lab or designated classroom space so visual enrichment materials could be incorporated.
- Need more flexible viewing spaces for seminars which would enable viewing and subsequent interaction and discussion.
- A dance studio with a sprung floor and natural light is desirable. Existing space in CRC to be used for exercise machines. This space would also be used for yoga which is an increasing activity on campus.
- Need flexibility and opportunity for spontaneous gathering.
- More studio space needed. Book binding studio near library would be ideal. More display and lecture space as well.
- Reading room / library space to showcase student and faculty work.
- Existing lecture hall is highly undesirable space for teaching but is also currently the only space where large gatherings can occur.
- Provide structures for inhabiting the woods so trees and campus are integrated. Classroom on the beach.

PUC II (4:10)

- An Environmental Studies Field Station would house field equipment, dirty lab space, approximate to forest reserves, 50 person classes, greenhouse, food grade lab and food storage. It could also house marine equipment if it were near the water.
- A sustainability Center could house meeting space, be a demonstration project, be a place for interaction with community members. The existing farm provides some of these as it is intended to be both eco-agriculture and eco-design.
- There is a need for potluck spaces for both faculty and students.
- A ropes or challenge course in the forest would be desirable.
- Built space should be a vehicle for teaching.
- There is need for both additional farmland to fulfill teaching requirements as well as land capable of supporting the food consumption on campus. Acres required per person information needs to be gathered to determine the impact of this.

End of notes.

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of the date of the notes.

MEETING NOTES: Scientific Inquiry PUC

MEETING DATE: April 11, 2007

BY: Don Miles

THOSE PRESENT:

TESC
Rachel Hastings (hastingr@evergreen.edu)
Rob Knapp (knappr@evergreen.edu)
Clarissa Dirks (dirksc@evergreen.edu)
Kevin Francis (francisk@evergreen.edu)
Vauhn Foster Grahler (fostergu@evergreen.edu)
David McAvily (mcavilyd@evergreen.edu)
Donald Mrisato (donaldm@evergreen.edu)
Isaac Overcast (overcasi@evergreen.edu)
Ken Tabbutt, Dean, Planning Committee

ZGF
Don Miles

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Topics discussed included the following:

1. Ken Tabbutt introduced the master plan process and Don Miles of ZGF.
2. The Quasar Center needs to be accommodated, a math and science zone. Four bay extensions (2,000 sf) of the Library is a possibility.
3. There needs to be a permanent telescope installation for students interested in Astronomy.
4. Red Square should be repaved with '0' runoff (permeable) surface.
5. In the long term campus should be served by wells and off the City water system. This would allow for chlorine-free water. The organic farm would also appreciate having chlorine-free water.
6. Bicycling should be encouraged with bike lockers, bike trails, and equal-gender shower rooms.
7. Space is needed for large, heavy student projects such as the wall sections created for Rob Knapp's program. Security is not essential to project these items. The space could be covered, but open with a walkable surface (a covered outdoor exhibition space).
8. The workshop spaces in SEM II are ideal teaching spaces (like A1107). However, the ventilation system makes too much noise and the room should have been naturally ventilated.
9. The Lecture Halls in Red Square are not ideal teaching spaces. For sciences, their only redeeming quality is the large amount of black board space and the fact that the screen does not cover up the blackboard, as it does in SEM II, A1107.
10. In general, more whiteboard (or blackboard) and tack space is needed for the sciences.
11. Scheduling space is difficult on the spur of the moment (such as for guest lecturers). It sometimes requires 5 months to secure classroom space.
12. Loose fitting, flexible space is needed for teaching (movable tables and chairs). Trapezoidal tables should be considered.
13. There is growing interest in faculty/student research. These activities require state of the art facilities with back up generators for power outages.

Another lab building is needed with breakout spaces for student/faculty interaction. Fred Hutchinson Cancer Research Center, designed by ZGF, was talked about as a lab building the does a good job providing such spaces.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of the date of the notes.

MEETING NOTES: Culture Text and Language PUC

MEETING DATE: April 11, 2007

BY: Don Miles

THOSE PRESENT:

TESC
Stacey Davis, chair CTL PUC (davisst@evergreen.edu; x6761)
Stephanie Kozick (kozicks@evergreen.edu)
Sarah Pedersen (pederses@evergreen.edu)
Steven Hendricks (hendrics@evergreen.edu)
Judith Gabriele (gabrielj@evergreen.edu)
Ken Tabbutt, Dean, Planning Committee

ZGF
Don Miles

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Topics discussed included the following:

1. Ken Tabbutt introduced the master plan process and Don Miles and Sara Howell of ZGF.
2. Ken was asked: what teaching space would be added by the Phase 2 Library renovations? Answer: three (80 person) work rooms on the first floor; two seminar rooms on the second floor.
3. The PUC said additional media classrooms are needed. The PUC liked the SEM II classrooms as they are media classrooms and faculty does not need to provide laptops and web access is available.
4. A central faculty lounge is needed sized to serve the entire faculty. This will be a place to relax, recharge, discuss new programs and encourage informal faculty interaction. It was pointed out that the Faculty Club at the UW is also a center for readings, receptions and donor functions. This space should have natural light, views, comfortable furniture, coffee, plants and catered food service. The consensus was that the current CAB plans do not adequately address this need. It was emphasized that the lounge is not just providing a collegial atmosphere, it serves a central academic need by providing a place for faculty to explore potential programs as part of curriculum planning. This would also provide a place for Emeritus faculty to meet.
5. The SEM II workshop rooms are popular because the lounge areas in the corridor provide convenient space for breakout sessions.
6. The current language lab space in SEM II is too small. The lab space needs to be expanded and an adjacent space provided for foreign language conversation space.
7. There is a desire that foreign languages and international students have greater presence on campus.
8. Additional “pop out” space in the Library could be considered as a potential for the language spaces.
9. The dance space in the CRC is going to be used for additional fitness equipment. Dance is being offered larger space in the building without natural light. Originally one of the ground floor workshop spaces in SEM II was slated for the dance studio, but this was later changed. Dance would like a space with a special dance floor, natural light, mirrors and bars. Yoga is also not well accommodated currently in the CRC (noise, pool fumes, etc.).
10. Comm building needs breakout spaces.
11. LAB II building needs lecture space for print making.
12. A book binding studio/book arts is needed in the Library by Rare Books department.
13. Enrollment Services intends to expand to the north in the lower floor of the Library.
14. There needs to be a faculty reading room exhibiting books written by faculty or showcased in their programs.
15. The current Lecture Halls in Red Square are not popular classrooms (discourage interaction and are not ADA accessible). A “redeeming quality” is that the lecture halls accommodate slide projectors

and document cameras (art history).
The Reserve trails are considered unsafe (personal safety concerns). More use of the reserve should be made, such as, having classrooms at the beach and structures for reflection.

End of notes

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MEETING NOTES: Environmental Science Faculty Comment Session for the Preliminary Draft

MEETING DATE: October, 8, 2007

BY: Crystal Passi

THOSE PRESENT:

TESC:	EMAIL:
Dean Rimerman, MPA Student	deane@efn.org
Rick Reichert, TESC Foundation	reicherr@evergreen.edu
Trevor Kinahan, Board of Trustees liaison To Geoduck Student Union, and coordinator of General Maintenance Committee.	trevorkinahan@gmail.com
Peter Impara, Member of Faculty	imparap@evergreen.edu
Martha Henderson, Member of Faculty	mhenders@evergreen.edu
Hirsh Diamant, Adjunct	diamanth@evergreen.edu
Frederica Bowcutt, Member of Faculty	bowcutt@evergreen.edu
Bob Levrich, Member of Faculty	leverich@evergreen.edu
Steve Sheuerell	scheuers@evergreen.edu
Paul Smith	

ZGF:	EMAIL:
Don Miles	dmiles@zgf.com
Crystal Passi	cpassi@zgf.com
Tim Williams	twilliams@zgf.com

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Comments:

1. Carbon footprint of the campus.

    -Limit development to already developed land, reducing carbon release into atmosphere.(Location of new arts building at lab controversial)
    -Deforestation, transportation and energy use impact carbon footprint
    -Carbon footprint article by MES student should be included in Master Plan
    -Arts build/lab building is cutting into nice tree stand, why do they have to be located there?

2. Terrascope vs. Geoduck House

    -ES faculty prepared proposal for site of the forest observation center with their vision:
        -Terrestrial and aquatic systems merge
        -Art and science form interdisciplinary study
        -Wild lands and human interaction
    -10,000 to 15,000 sq ft. Wet lab space, art classroom space.
    -Geoduck house has problems in terms of site, sensitive because of closeness to water.
    -If Terrascope replaces Geoduck Marine Science Center idea, that portion of beach could be more or less closed.
    -Terrascope would have caretaker like Organic Farm.

-Dirty lab space here would be exclusively for EG material, dirty lab space at core would be for Mat from outside campus.

3. Comparison of Evergreen for Square footage per student needed?

4. Organic Farm issues.

-Greenhouse location.
-Portion of land across the street from farm that is owned by college has good soil and should be included into 25 acre allotment for farm.
-Could plan give a better estimate to farm folks of where these 2 acres are, add to maps while excluding wetland buffer zone.

5. Emphasizing interdisciplinary learning in design of infrastructure.

-Buildings the draft propose are too conventional and don't emphasize unique teaching experience at Evergreen.
-Maybe nomenclature should change to show this, making it more inclusive.
-Sustainability space for archives needed.

End of notes

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MEETING NOTES: Master Plan Review Meetings

MEETING DATE: October 10, 2007, 3:30pm

BY: Don Miles

THOSE PRESENT:

TESC	ZGF
Paul Smith, Facilities Services	Tim Williams
Ariel Goldberger, Expressive Arts (arielg@evergreen.edu)	Don Miles
Walter Grodzik, Expressive Arts (grodzikw)	
Ruth Hayes, Animation (hayesr)	
Bob Leverich, Visual Arts (leverich)	
Peter Randlette, Dir. Electronic Media (pbr)	

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Presentation
Tim Williams presented summarized the current draft master plan with a PowerPoint presentation.

Topics discussed included the following:

1. Concerns were expressed with the new building massing locations and configurations at the west edge of campus. Some felt this location would result in campus sprawl and preferred to keep the Core concentrated by developing the site north of the CAB for new academic uses.
2. Another suggestion was to redevelop the current Lecture Hall site for more intense (multi-story) academic uses.
3. Sem II was put forward as a model for the next generation of academic buildings on campus. Sem II has a variety of teaching spaces, including large, flexible studio spaces that reflect the unique teaching style of Evergreen.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of the date of the notes.

MEETING NOTES: Master Plan Review Meetings

MEETING DATE: October 11, 2007, 1pm

BY: Don Miles

THOSE PRESENT:

TESC	ZGF
Paul Smith, Facilities Services	Tim Williams
Brittany Newhouse, Geoduck Union (newbri31@evergreen.edu)	Don Miles

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Presentation
Tim Williams presented summarized the current draft master plan with a PowerPoint presentation.

Topics discussed included the following:

1. Likes the concept of adding two new buildings on the west side of campus to create a hub and to balance campus activity.
2. Likes the community stewardship of trails and that students will be actively engaged in campus stewardship.
3. Likes the cottages/eco-village concept and notion of upgrading and expanding Quad housing. Questions any further investment in Soup housing (deemed in poor physical condition and an undesirable housing type—upper floors are not ADA accessible).
4. Likes proposed renovation and expansion of the CRC to accommodate expanded wellness and fitness facilities and a front door facing the housing areas of campus.
5. Likes the idea of retail (not franchises, but uses such as local branch of Olympia Food Coop).
6. Likes the idea of incorporating small seminar and social rooms in the ground floor of new residential development fronting pathways.
7. Favors improved maintenance of existing and proposed housing.
8. Does not support building north of the CAB because the renovations to the CAB will make it a greater social hub and close adjacency to academic uses is not desired.
9. Supports demolition of the Lecture Halls to create more flexible teaching spaces.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of the date of the notes.

MEETING NOTES: Master Plan Review Meetings

MEETING DATE: October 11, 2007, 1pm

BY: Don Miles

THOSE PRESENT:

TESC	ZGF
Bob Leverich, Visual Arts	Don Miles

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Topics discussed included the following:

1. Liked the diagonal connection from Red Square to west campus and the siting of two buildings to form a new hub.
2. Supports the idea of a Sustainable Arts and Sciences facility in two buildings added west of Lab II and the Arts Annex.
3. These two new buildings should have 3D studio space similar to the 4th floor of SEM II.
4. Supports the idea of potential rearrangement of the shops in the Arts Annex as part of the renovation of that building.
5. Supports the idea of new academic space north of the CAB. This building might also focus on sustainability and include two large studio spaces and a small wood (model) shop. Building should accommodate 60 students and 2.5-3 faculty.
6. Okay to should potential development sites (dashed lines around sites), rather than specific building configurations. Would be desirable to include photographs illustrating the character and scale of proposed development.
7. Likes Art Walk on the revision to Overhulse Place. We need to consider a terminus at each end. A future community connection (roadway connecting to Driftwood?) would provide a terminus at the north. A green design and sculpture park should be located at the southern end. This area would act as a gateway to the art walk and a zone for student sculpture and design/build projects.

End of notes

The content of these meeting notes represent, to the best of our knowledge, an accurate recording of the topics covered. Please forward corrections or additions to Tim Williams at twilliams@zgf.com within 10 days of the date of the notes.

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PRELIMINARY DRAFT COMMENTS

(November, 2007)

These comments were submitted for the preliminary draft versions of the Campus Master Plan during the Summer and Fall of 2007. We apologize for any missing comments as we have done our best to include as many received comments as possible.

11/30/2007

Lee Lyttle

An important part of sustaining a viable sense of the Evergreen community is the planning of spaces, both covered and exposed, for community gatherings of varying types and sizes. Places that currently serve this function include Red Square, the Library Lobby, the Longhouse, the CRC, the CAB, Sem II's coffee shop, and the Soup Housing. There are other less formal ones. It would be helpful to have more discussion and design ideas on these areas included in the Campus Master Plan. The blue circles on page 47 seem to be a start at this. Areas such as these, with some identified interior spaces, should be the targets of performance criteria and suggested design elements.

10/30/2007

To VEA Colleagues and CLUC members, and ZGF folks,

I was asked by the Visual and Environmental Arts sub-area to report back to them on the Draft Campus Master Plan. I've attended the meetings this fall where the architects were present, and also met over lunch with Don Miles from Zimmer Gunsul Frasca to discuss the Draft Plan and VEA ideas and needs. To VEA folks I'd say that the Draft Plan is a thoughtful and carefully assembled document, intended as a supplement to the existing Master Plan, not a replacement. It addresses primarily the future of the built infrastructure of the campus. I'm not setting out to summarize it for you here. Rather, I've put down a list of comments, observations, ideas and suggestions that I've collected from meetings and conversations with faculty, staff and ZGF. Just to get them on paper for the architects to consider as they revise their draft plan.

<u>VEA Remodeled and New Space Needs</u>
As college enrollment grows, so does enrollment in our area. Visual and Environmental Arts are a key draw for students at Evergreen. We are increasingly strapped for teaching space due to enrollment growth, and due to studio spaces being taken "off line" for months and years as other buildings are remodeled on campus. The Draft Master Plan proposes a remodel for the Art Annex and new visual and environmental art space as part of a proposed building to the west of the Annex. VEA faculty feel that the proposed remodel date for the Art Annex (the 2015-2017 Biennium) is too far out. A remodel of the Annex needs to be carefully considered in conjunction with a plan for additional VEA space. We need that additional space for the VEA area to retain faculty and staff, maintain current student numbers and to expand those numbers.
Our most pressing needs include:

- Additional Sculpture/3D Studio teaching space with proximity to wood and metal shops
- Sculpture "Yard" space – an outdoor work area for sculpture (we use the Lab Loading dock now
- Studio space for contract and senior thesis students working in 3D,
- Additional research studio space for faculty.

Other spaces that are on our list:

- A Sustainable Design Studio with proximity to wood and metal shops (or small "satellite" shops), environmental science labs, GIS and computer labs…
- Expanded ceramics studio space (Jim Blevins proposed a fire arts building a while back…)
- An above ground printmaking studio!
- Bench room spaces for the wood and metal shops
- A covered, outdoor forge area

<u>Program Clusters</u>
The architects and I discussed a design model I'd call "program space clusters," similar to Seminar II,

where seminar spaces, lecture spaces, large multi-purpose studio spaces, break-out spaces, critique and presentation space, and offices are grouped together to serve programs. This model works quite well for 2D arts programs and Sustainable Design in the Seminar II building. A new arts and sciences building could have lab and research spaces adjacent, as well, for interdisciplinary programs. The architects have recognized the need for several more multi-purpose, studio teaching spaces on campus.

Terrascope – Sciences, Arts and Sustainable Design

Nalini Nadkarni has proposed a building at the northern terminus of a Forest Canopy Walkway, adjacent to the Sound. This facility would serve for study of not only forest ecology, but also marine ecology, and 2D arts. Erik Thuesen, Lucia Harrison, and Susan Aurand have all expressed interest and support for this idea. There's concern about putting a new building at some distance from the "campus core." Still, this could be an interesting location for one of the multi-purpose studio teaching spaces mentioned above. It would be more problematic to address 3D work there because of the distance to the shops, unless smaller shops, that might serve both art and science needs, were included.

A sustainable design studio might quite justifiably be located at the Terrascope, or at the Organic Farm, or the Alternative Energy Center suggested in the plan, east of the COM Building. There is something to be said for putting a cluster of spaces to serve Sustainable Design programs in a more visible location in the campus core, in the remodeled Lecture Halls complex, perhaps, or in an "environmental inquiry center" east of the library along the main walking route to housing. People like to see students designing and building things. It generates interest and enthusiasm.

VEA and EE

The pairing of VEA and EE in a new building near the Art Annex at some future point seems arbitrary to us in VEA. It seems that locating EE away from central campus and close to parking was what prompted the idea in the designers' minds. Given that the financial viability of EE has yet to be established, and that approval of EE is supposed to come up for a faculty vote next year, giving it a half a building in the Plan seems hasty. Could we visualize ourselves sharing a building with EE? Yes, probably, but there are other pairings that seem more natural to us, notably with the Sciences.

Jean Mandeberg has been a key bridge builder between Evergreen and local and state arts organizations,. She suggests that if Extended Education is approved after next year, and if Extended Education focuses on teaching in studio spaces, that the EE program focus on working collaboratively with the City of Olympia to include appropriate studio space in an Arts Center downtown. Such a plan, she notes, would be a way to have a very visible Evergreen presence in downtown Olympia and provide studio space more suited to EE short-term workshops than the studio space we need for full-time programs on campus.

Environmental Art Outside

Don Miles and I discussed the possibility of having an outdoor area where students and faculty could develop short and long term, but generally temporary outdoor artwork and construction projects addressing site and environmental issues. A section of Overhulse Road is already slated to be abandoned as a roadway by the College. We discussed using it for this purpose.

Interdisciplinary & Interspersed

Peter Randlette noted that Arts are spread out on the east, west and north edges of the campus. Sciences are clustered in the southwest corner. What if a new science building were, say, north of the CAB? The argument is that sciences can't be spread out. Why? We discussed the possibility of a building that might house sustainability studies, including sciences and design in that spot north of the CAB or a more central spot on campus.

Gallery? Museum?

If we might build new arts spaces, and if we might remodel the Lecture Halls directly adjacent to Red

Square, might we not want to consider a more visible, more generous Gallery for the College?
Ken Tabbutt has mentioned that there is no place for scientific collections of materials from off campus. Could these collections be housed and displayed?
What about collections, of art, personal papers, and other study materials that the College owns or could own, if it had the space for them?

Downtown Outreach
The subject of exhibit space, lecture space, teaching space and studio space downtown in Olympia, repeatedly get raised. It would be good to unpack the idea some more, and see if it belongs in the Master Plan. It could be a useful strategy for bridge building as well as education. Many architectural programs have "Community Design Studios," often in storefront locations that heighten their day-to-day visibility. Other community-based programs could readily employ such teaching and learning space.

Tacoma Outreach
Not a lot of visual art gets offered at the Tacoma Campus, it seems. And not many VEA faculty have taught there. Not an issue for the Master Plan, perhaps, but wouldn't it be interesting if they had a studio space there… The Draft Plan does propose adding another floor of space to the building – no studio, though.

Outreach Building to Building and Beyond…
I've heard people suggest more covered walkways between buildings (maybe even on several levels?), and extending out to principle parking lots. Check out SPSCC.

Overnight Housing
Sarah Ryan suggested to me that the Master Plan address the need for overnight housing for students who commute from outlying communities for EWS programs.

Thanks for your attention-

Bob Leverich

10-18-2007

Hi Ken,
Now that you have been in Sem II a while and gotten a sense of the layout, you may have noticed that all the bike hook ups are exposed to the rain, wind, snow, etc. (clearly designed by a non-bike rider). Unlike other places on campus (the Lab I & II breezeway, the library, eg.) they are not covered. Although I generally park near my office, more and more my day is ending up in the Sem or Com bldg and it is much easier to go straight from there, esp. when I will be fighting the dark in a couple of weeks. At the end of a long day who wants to get on a soaking wet bike with rusting cogs. SO......the point of all this, from one bike rider to another, is, can you suggest to whomever the right person is that the bike parking places around the sem II bldg. be COVERED.??? I know this is not the most pressing item on campus, but it would be nice if it could be attended to.
thanks,
jeanne

From: Ransom, Bill M
Sent: Monday, October 15, 2007 3:03 PM
To: Smith, Paul
Subject: Master plan

Hello, Paul—I had two thoughts regarding the master plan: 1) ventilated space for oil painting in the art area. 2) wider stairways for emergencies.
We have hoods and ventilation for labs but nothing that provides for removing fumes from working in oils, so we currently discourage students from pursuing oil painting. I was a firefighter/medic for 12 years and find the exterior stairways in Sem II too narrow for me to go up in full gear while people are escaping from above. Also a difficulty with patient transport on gurneys or backboards since we can't expect to have use of elevators. Some would say, "We have plenty of stairways, choose another one," but the nature of emergencies is that we don't know whether any, much less all, stairways will be available for escape and rescue. Best to consider that each stairwell may be the only one available. Anyway, that's my two bits' worth. Hope that ankle's healing up. Best wishes, Bill

Bill Ransom
Academic Dean of Curriculum
The Evergreen State College
2700 Evergreen Parkway NW
Seminar II, D4107
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ransomb@evergreen.edu
360-867-6880
www.sfwa.org/members/ransom

10/04/2007
Hi Ken,

Thanks for your remarks at today's faculty meeting. They prodded me to look over the master plan. I confess I didn't read it top to bottom, so forgive me if some of these remarks sound half informed. They are in no particular order of importance, and I hope the committee finds them of use.

My understanding is that when colleges face trouble with student recruitment and retention, the most effective strategy is to build a state of the art sports/rec center. I see there are plans to expand the CRC. I'd just emphasize that this is a curricular concern. If we don't attract the best students (best for Evergreen) nothing else on campus can happen. A great gym would be an ENORMOUS benefit. Plus, there are all kinds of programs that cross mind/body divisions, which should help everyone see that the CRC is a curriculum priority.

On the same note, attractive, comfortable student housing would help us so much with the attrition problem. So it is also a curricular concern.

Maybe restroom facilities are mentioned in the fine print, but I didn't see them in the plan. We have a significant number of people in our community who aren't comfortable with restrooms designated male/female with few other options. We do have a few gender neutral restrooms. But many of my students identify as transgender or gender queer or are in a place of transition with regard to their gender presentation. Forcing people of diverse gender identities and expressions to select either male or female restrooms is a burden that could be easily avoided if all future construction prioritized gender neutral restrooms.

Regarding transportation and getting more people to campus in fewer cars I saw mention of Lacey residents. Actually, our community is spread even wider. I always have students from Tacoma and Seattle in my classes. The master plan should address the entire I 5 corridor. For example, we should have a direct Lacey-campus bus, but we should also at a minimum have a direct bus to connect us to the Tacoma transit hub (light rail and Sounder Train). It would also be wise to connect to Seattle--perhaps to the SeaTac airport light rail station when it opens, or to some other transit hub. This could also help us with recruitment and retention. Many people want to attend Evergreen but transportation stands in their way.

I didn't see (excuse me if I read too quickly) mention of the considerable potential the campus has to expand its capacity to host arts events. I don't have figures at ready access, but I've been told that arts related events can generate lots of revenue for localities. Imagine an outdoor amphitheater if we could attract summer theater or concerts. Imagine a gallery--a building dedicated to exhibitions. We could make the campus an arts destination in a region that is already a tourist destination.

I saw mention of a conference center. This seems to be along the same lines a potential income generator with great potential. I'd like to emphasize that it could have tremendous benefit for curriculum as well. People like to travel to the Pacific Northwest. Imagine the kinds of academic conferences we could host if we had the facilities, and the kinds of tie-ins to student learning.

I didn't see whether there is specific mention made of our shoreline. I can imagine a small conference center built on the water. That would be great for income generation. Plus, why not locate the faculty club there? And a dock for our boats?

Here's an idea that many (perhaps most) of my colleagues won't like: I think we should develop a commercial strip on campus with businesses that support student life: cafes, restaurants, photocopy stores, grocery stores, etc. And I think it should be on the Parkway so that we capture all the Olympia commuters who use our campus to get to the freeway. The college could use the revenue, and the students need the services. Imagine if we just had a drive-through coffee stand in each direction on the parkway!

I'll end with an idea less controversial, and quite easy: covered walkways between all the buildings in the campus Core so that people can walk in the winter without getting wet.

If I think of anything else I'll send another note.

Thanks for your work on this, and for all your work.
Greg

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Comments on the unique spaces and buildings at Evergreen
Submitted by Jenni Minner on Wed, 2007-09-12 13:26.
I think Red Square is an important symbolic and functional space. We use this space for graduation, perhaps the most important milestone for students. Parents and friends of graduates visit the campus at graduation and the community visits on Super Saturday and for other events. I hope that in any redesign, Red Square remains functional with adequate space for large events and retains the monumentality that was originally designed.

Other comments... Sustainability isn't just about building green buildings. It is also about preserving the buildings we have on campus. It is often easier for people to think of building a new green building and forget about restoring and reusing existing buildings and spaces. When we retrofit, remodel, and landscape will we take into account the environmental cost of new materials and their longevity? Also, let's not make the same mistake of putting seismic walls on building exteriors - The library building was really defaced when walls were placed on its exterior. I hope the CAB remodel is sensitive to the look and feel of the original building.

My favorite places on campus
Submitted by scoste05 on Thu, 2007-07-26 21:07.
My favorite places on campus is the woods behind F-lot and the Organic Farm, and when it's sunny out, the open fields by housing, mostly because they have so much COLOR. I feel like the college has done a great job with maintaining a core campus within the extensive campus property. I also like the buildings of Sem II with their sleek, modern look and also because they are highly efficient in using energy resources.
I encourage more rooftop gardens, and also to make the other concrete structures look less forboding, including the clocktower. When it's winter in Washington and the buildings are the same color as the sky, it can get very dreary and depressing on campus. Add more color, make it feel less like a prison and more like a college.

I find that there is no good
Submitted by Anna S. on Fri, 2007-05-11 15:33.
I find that there is no good way for pedestrians to travel between red square and evergreen parkway. I jog down the road at times but either have to jog through the parking lot where there are no sidewalks either, or along the road past the information booth, which does not feel safe.
I believe it would benefit students and incorporate academics into the on-campus living community to have students design and upkeep some of the landscape around housing (specifically apartment style housing) by food gardening or specific habitat landscaping with native plants.
The first (bottom) floor lobby of the library is almost always unused. Maybe it should be converted into a study and meeting space.

Something for the neighboring community
Submitted by alfonsoa on Mon, 2007-04-09 12:31.
A permanent parking area near the soccer fields and tennis courts. A lot of our neighbors enjoy using the fields, trails and walkways, particularly on the weekends, for recreation and exercise. A while ago, one of my neighbors was parking off the street and was ticketed when he attempted to attend a soccer match. Unfortunately, the experience left him and his children not feeling welcomed at Evergreen. There is now a temporary lot which seems to be just the right size and fit for the use. Making it permanent somewhere in that vicinity would be nice. It could also be used for drop off and pick up of children attending the various athletic camps offered throughout the year.

10/25/2007

Hi Ken,

Thank you for your work to accommodate the faculty resolution to create more opportunities for input on the Campus Master Plan. After attending two meetings on Monday, October 8th, one on October 24th, and reading the draft master plan I have the following comments.

Reduce Carbon Footprint

I applaud the efforts ZGF made to identify ways to reduce our carbon footprint. Faculty and staff housing would help to meet this goal. However, locating it adjacent to Cooper's Glenn will make this unlivable for those needing more privacy in their down time. A more secluded, cottage development of eight to ten small homes near the Organic Farm would make it possible for faculty and staff living there to walk to work via the Organic Farm trail. Faculty housing could also be included in the higher density development near existing student housing. Excellent models of faculty housing exist from other campus communities including University of British Columbia at Vancouver, University of California Davis and University of California Los Angeles. At UCD homes are owned and maintained by individuals who enjoy limited equity opportunities. The University retains ownership of the land and retains the right to buy back homes when the owner is ready to sell. This is a faculty retention issue as well, particularly for new faculty and staff who may find it hard to afford a home near the campus given rapid appreciation of homes in the Olympia area. According to Windemere, the median price of an average three bedroom home is now nearly $300,000 in Olympia. I support shorter-term faculty housing in the urban suite style at the Driftwood location with nearby retail and long-term limited equity homeownership near the Organic Farm in the form of cottage style housing.

Regarding transportation and getting more people to campus in fewer cars, I support the idea of adding a shuttle. Our community is spreading westward to the neighboring Griffin Peninsula and Mason County. I recommend that the western-most shuttle pick up location be near Island Market off of Highway 101. There's a park and ride near the Highway 101 overpass. Currently bicyclists from the Griffin Peninsula must ride their bikes on Madrona Road, which has no shoulder and poor visibility making it very dangerous.

Building Community

A state of the art recreation center/gym would go a long way to improve the quality of life at Evergreen for faculty, staff and students. I agree with Greg Mullins that this is a curricular concern because it would attract students and support programs that cross mind/body divisions. Given our unique location on the Puget Sound, we should transform the Geoduck House into a water recreation center with composting toilets, non-motorized boat storage and a dock. Some community members already use this location to commute via the water to campus. More secure boat storage would further encourage this use as well as recreational use. The crew team could also be centered at this location.

Development of a commercial strip on campus (at the side door location) with businesses such as a café and restaurant would make the campus more livable. Current food options are too limited. Place making hubs in the core of the campus would make the campus more inviting. Edible landscaping such as fruit trees against south facing walls of buildings to capture heat reflected off the concrete would complement this intension to create more human scale gathering places on campus. Organic Farm staff members have expressed interest in bringing food production into the core of campus at least on a small scale to make what they do more visible.

Expanding the Lecture Hall with garage doors opening to Red Square is a brilliant idea. Not only would such a renovation transform a structure that currently resembles a bomb shelter, if used for sustainability it would put this important initiative front and center literally. Hopefully impacts to the existing Waterwise Pollinator Garden would be kept to a minimum.

Our Teaching Gardens and trails represent a golden opportunity to build political capital with our neighbors and entice future students by providing both recreational and educational opportunities. For example, both could serve as a destination for K-12 students in the area seeking an environmental education experience. I support ZGF's proposal for better signage and the creation of a loop trail. These would invite the greater Olympia community to our campus.

Land Base

I support the renaming of the reserves to help create a sense of place. The current names in the previous campus master plan are unimaginative and do not give a sense of what is in those reserves. Does it make sense to note that the wetland parcel to the south of the Evergreen Parkway should be purchased if the opportunity presented itself? Acquisition of that land would link our Grass Lake Wetland Reserve to the more extensive Grass Lake land owned by the city presenting an opportunity in the future to conduct field trips to a rich and large wetland system in public ownership within walking distance.

Three Binders

I appreciated clarification in ZGF's presentation that their work is an addition to the most recent Campus Master Plan. I like their idea to also add a third binder of appendix materials. The faculty and CLUC approved arboretum plan ("Imagine a Greener Future") should be added to Volume III. I would be happy to provide a digital copy of this report.

Thank you for the opportunity to comment on the draft Campus Master Plan. This is exciting work to help envision the future of our campus.

Frederica

9/26/2007
Hello Tim:

There is one broad fatal problem with the draft master plan. Many important parts of the current Master Plan have been discarded. This is clearly a case of throwing out the baby with the bath water. I understand that your group has been hired to produce a new master plan and that if you had just cut and pasted parts of the 1998 master plan into your first draft, it might look like you guys hadn't done any work. However, some sections of the 1998 plan need to be retained. Referring to the old plan is not sufficient. The way Evergreen works would mean that there would be an "old plan" and a "new plan". The old plan would be invalidated by the new one. The Environmental Studies planning unit depends on the master plan to protect and manage the campus lands that we need for our teaching.

For example, Chapter 4 in the 1998 plan entitled "The process for land use planning" needs some revision. That section is very very important for us and a revised version of that chapter must be included in the new plan.

Also, the sections in the plan that delineate the specific reserves and the rules surrounding the reserves also need to be included in our updated master plan.

When I used the word 'fatal' above, I am being accurate. Without incorporating the important sections of the 1998 master plan into the current master plan, faculty will protest to the President and Board of Trustees. This will result in a failure by the BoT to adopt the master plan. It would serve no one for that to happen.

Your group has done a fine job of tackling this so far. I hope you'll be able to retain large sections of the 1998 Master Plan within the one you are producing now.

What would be the most efficient way for us to help you choose which sections of the 1998 master plan be included in the new master plan?

Thanks,

Erik
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7/23/2007
Hi Crystal:

I don't see how it is possible to focus recreation on the beach. I think it is better to discourage all recreation on the beach itself.
It will be impossible to prevent it, but I think keeping all signs worded to discourage recreation is best. I think inviting any recreational use of the beach will result in an avalanche of use during peak use days. That being said, it might be worthwhile to try something like that out. The big problem here is the way that a trial period would work. The CLUC is dysfunctional regarding these types of issues. So, given our current administrative structure and lack of functional academic oversight of the CLUC, I could not support such a trial period.

Faculty have spoken about how to re-write the section of the Master Plan regarding the CLUC, and I expect that something will come up in this regard during the comment period. It definitely needs revision, now that we have given it a 10-year trial period and know where the weaknesses are located. If the director of facilities is going to be the chair of the CLUC, there must be some oversight. Using academic deans as a co-chair has proven useless; they are too busy to do a decent job. So, the present system is just the fox guarding the chicken coop. Minimally, there needs to be a mandatory comment period for anything regarding use of the reserve areas and veto power by the environmental studies faculty for things that are undertaken in reserve areas. Some faculty want to prevent the facilities director as chair, but I'm not sure that makes sense. I think that oversight would be better.

I think that the other things you mention below are all fine.
Regarding partnering on conservation issues, somebody at Capital Land Trust would be the right person to work with. I've only had limited contact with them. I think that faculty member Carolyn Dobbs would be the person to talk with about contacting somebody there.

The only thing that might be mentioned would be fish-bearing waters.
There are technical terms for these, I am not sure what the current usage is. I think the old 1-5 scale has been modified since I last worked with it. The three main streams on campus are fish-bearing (or at least historically so).

Hope this helps,

Erik