cradle to cradle

to landscape architecture

Amanda Mercado Senior Project in Landscape Architecture

Abstract

The purpose of this project is to bring the concept of Cradle to Cradle design into the field of Landscape Architecture. I hope that through this project I can inspire my peers to be more aware of the gaps that exist with current sustainability trends. If Landscape Architects learn to work with a more holistic approach to sustainability, we can establish a new precedent of built landscapes that function in harmony with the natural environment.

Survey data shows that Landscape Architecture place a low importance on environmental sustainability in their designs. Furthermore, common sustainability trends fail to address the larger context of ecology. Individual sustainability features can enhance the function and efficiency of a site but are not eco-effective if they are not integrated into a larger system. To understand this three sites of different scales are examined in case studies. These sites are examples of systems-based design in which the goals are zero-waste and integration of the built environment into the natural environment. The central principles presented embody the ideals of McDonough and Braungart, John Lyle, and many other design philosophers.

Acknowledgments

There are so many people to thank for contributing to this project...

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My Family

Mom, Dad and Alex, I am so lucky to have you. Even though you were far away through college, I knew I could always count on you for unconditional support. I'm so happy that you will be here see what I have worked on this quarter. I love you!

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Preface

I chose to study Landscape Architecture because it gives me the opportunity to incorporate two of my passions, design and the environment. Although it is such an ideal forum, Landscape Architects are constantly neglecting opportunities for environmental sustainability at various levels. Over the course of my education at UC Davis I have learned many design practices that help the built environment to have less of an impact on natural systems. The problem with these solutions lies in their limited capacities and the lack of continuity throughout site designs. Concepts like gray-water irrigation systems and permeable concrete are all a step in the right direction however they stand alone in their functionality. They are what William McDonough and Michael Braungart would refer to as eco-efficient, not eco-effective. My intention in completing this project is to promote design that is eco-effective rather than eco-efficient. I would like for my audience to understand that including current trends in a design, or even receiving points from a rating system does not make a site "sustainable"; there is no cookie-cutter answer to sustainability. I aim to research and showcase opportunities for true environmental sustainability in a built landscape.

I hope that through this study Landscape Architects can be more comprehensive in their attempts for "sustainability." I hope to increase awareness of the cradle-to-cradle concept and the potential for it to be utilized in Landscape Architecture. I also hope to make people aware of the shortfalls of many systems that are simply eco-efficient rather than eco-effective in function. Ultimately I would like to emphasize the need for more progressive thinking and higher standards of design by Landscape Architects.

Introduction

Design As A Signal Of Intention

As Landscape Architects, stewards of the environment, we are all aware of the grave challenges facing our planet. We understand that modern civilizations are exhausting resources, polluting the earth and destroying delicately balanced ecosystems. So the question is, what are we, as designers, doing about it?

"Design is a signal of intention." This quote, from the book Cradle To Cradle by William McDonough and Michael Braungart, simply states our responsibility as designers, particularly designers of the built environment. If we examine the intentions of the human species we will notice a particular void in regards to the environment. We are currently following a 'strategy of tragedy,' which is not a result of malicious intentions, but rather a lack of any unified intentions. This de facto plan is not only flawed, it is unnecessary. We, as a human race, need a new plan; a plan of regeneration, abundance and resilience. Lucky for us, the revolution begins with design.

As John Tillman Lyle explained in his writings, every site that we design is an ecosystem. In every detail and decision that we make, we are constructing a system. When we design spaces with a singular-purpose, their systematic functions reflect that decision and fail to support natural ecology. Simply stated, "form influences ecosystem function" (Lyle, 114). Bearing this in mind, we as Landscape Architects must learn to consciously design ecosystems that sustain and enliven the world around them.

Over the course of our education at UC Davis we have learned many sustainable design strategies. The problem with these solutions lies in their limited capacities and the lack of continuity throughout site designs. These design components are a step in the right direction but stand alone in their functionality. They are what William McDonough and Michael Braungart would refer to as eco-efficient, not eco-effective. My intent in this project is to promote design that is eco-effective rather than eco-efficient. In order to accomplish eco-effective design, we must understand that including current sustainability trends in a design, or even receiving points from a rating system does not make a site "sustainable"; there is no cookie-cutter answer to sustainability. In the following sections of this study I aim to analyze and showcase opportunities for environmental resilience in a built landscape.

Section I
Cradle To Cradle Design

Cradle to Cradle Design entails design in which the concepts of waste and food are interchangeable; products can be either biological nutrients (they can be returned to the earth for 100% re-consumption into nature) or technical nutrients (they can be infinitely recycled and re-used without loosing any value). In a cradle to cradle system there is zero waste.

This cyclical cycle of nutrients and energy is no new idea; it has been the fundamental basis of life on earth for billions of years. An example that William McDonough and Michael Braungart use in their book is the cherry tree, which produces far more blossoms and fruit than it needs to propagate. Although many of these ‘excess’ blossoms and cherries fall to the ground, they are far from waste. These nutrients support the surrounding ecosystem and nourish the soil, which ultimately sustains the cherry tree as well.

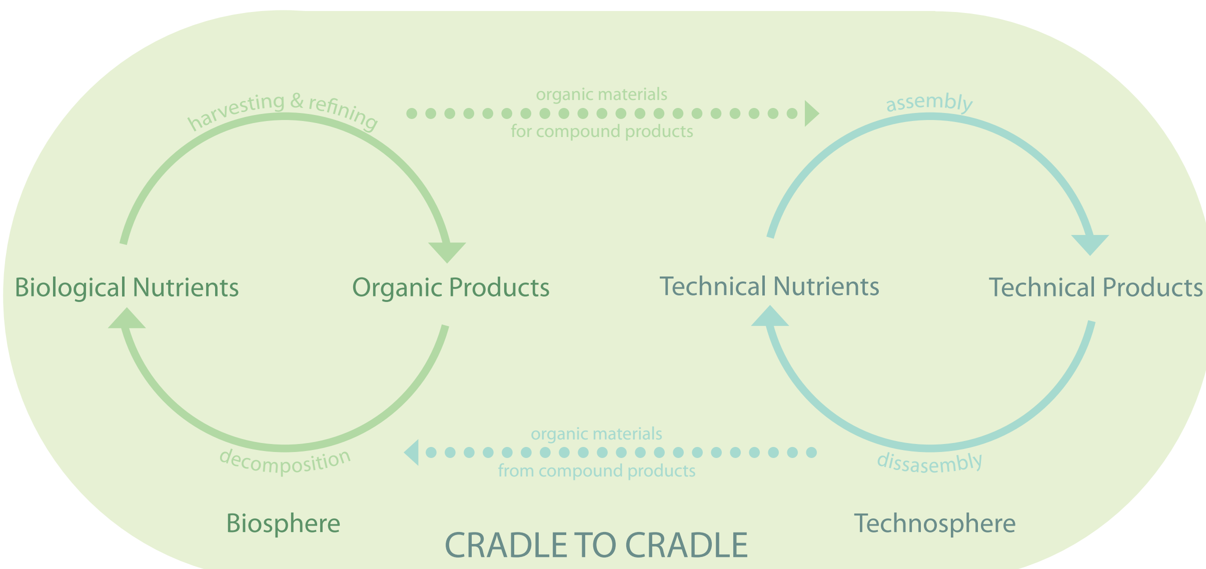

Figure 1.1 Cradle To Cradle Diagram

Although the ecosystems of the earth were built upon cradle to cradle nutrient flows, our modern society employs cradle to grave systems. The origins of these flawed systems are not particularly distinguishable, but developed as a result of agricultural practices, waste management and the industrial revolution. Literal and figurative nutrient flows were altered to accommodate expanding civilizations and ultimately they retained no integrity of a natural system. Our culture produces copious amounts of waste. In many cases these wastes have been manipulated to the point that they can no longer serve as nutrients to another system, they are doomed to their state of "waste." One simple demonstration of a monstrous hybrid can be found in a seemingly harmless leather shoe, in which leather (a biological nutrient) is contaminated from chromium tanning then coupled with a sole composed of rubber, lead and plastics (McDonough and Braungart, 99). Not only does this product harm humans during production and contaminate the environment throughout use, it is ultimately discarded, condemning once valuable nutrients to a landfill. Such products are referred to as "monstrous hybrids." The problem with these products lies in their fundamental design, which combines biological and technical nutrients into a state that they cannot be sorted and salvaged.

As vast quantities of nutrients are being buried in landfills, we are quickly exhausting natural resources. This imminent reality has prompted a trend of "sustainability," in which environmental activists aim to slow the pace at which humans consume resources such as oil and timber. These "sustainable designs" help existing systems be 'less bad' but fail to truly solve the problems at hand, they are simply "eco-efficient". The intentions of these eco-efficient designs are sincere, but ecosystems do not function within limits, they employ strategies of resilience. The concept of efficiency entails maximizing a system, but when the system employed is fundamentally destructive, efficiency simply acts as a catalyst to destruction.

Products or systems that follow these principles can be considered "eco-effecitve" and exist from a concept of zero waste. By following the principles of ecosystem function, we can thrive in harmony with the natural environment. This begins with a paradigm shift in design.

> "To eliminate the concept of waste means to design things- products, packaging, and systems- from the very beginning on the understanding that waste does not exist."
>
> -McDonough and Braungart

Key Words And Concepts

1. Eco-efficiency: design that help existing systems be "less bad" but fail to truly solve the problems at hand; a commonly employed, but ineffective, strategy for "sustainability"
2. Eco-effectiveness: design that exists from the concept of zero waste; these design products or systems function flawlessly with nature, supporting human activity while also nourishing the natural environment

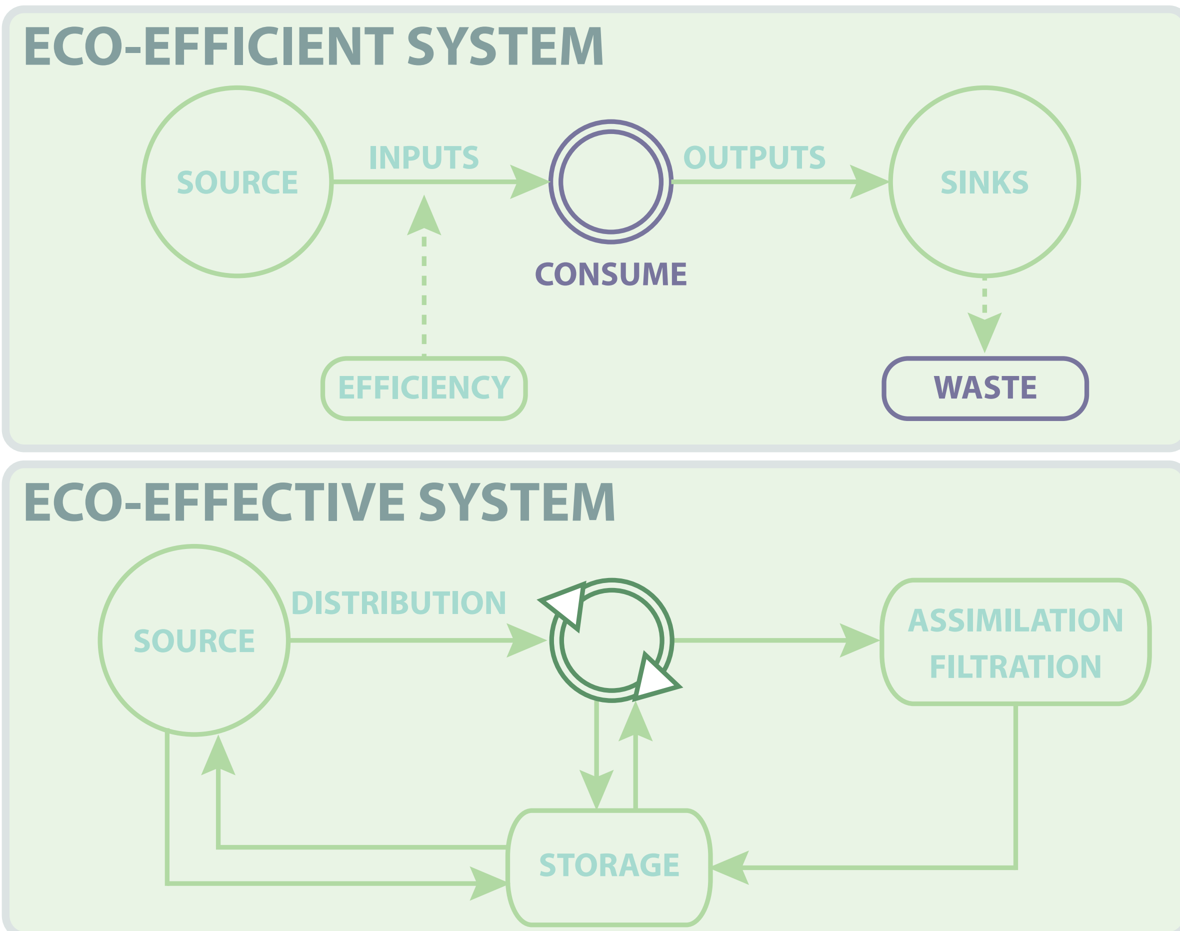

Figure 1.2 Eco-Efficient Vs. Eco-Effective

3. Downcycling: the reality of modern "recycling" in which nutrients can be re-purposed but fail to retain the same value throughout different lifecycles; this practice slows the wasteful trajectory of modern products but does not solve the inherent problems of design

4. Upcycling: an effective system of re-use in which materials retain their technical value throughout an infinite number of uses; this requires products be designed to accommodate the recovery of all technical nutrients after use
5. Monstrous Hybrids: products that combine biological and technical nutrients in a way that they can never be reclaimed after the product is obsolete/ old, resulting in large amounts of waste; includes most technology like computers
6. Biological Nutrient: an exclusively organic material that can be used in assembly of a product, then disassembled and decomposed to nourish the earth and be entirely absorbed back into natural systems (the biological metabolism)
7. Technical Nutrient: materials that can be used in a product then recovered to be re-used; this material nourishes the technical metabolism by retaining the same value throughout an infinite number of "lifecycles"
8. Cradle to Grave: a linear path of product assembly, use, then disposal
9. Environmental Design: design in which human ecosystems are integrated with natural ones to yield mutually beneficial relationships manifested physically through the form of the built environment

Section II

Eco-Efficient Trends In Landscape Architecture

Current, eco-efficient trends can be described with words like reduce, minimize, and limit. In the field of Landscape Architecture, this translates to reduced water demands, minimal habitat impacts and limited pollution. As awareness of environmental conditions increase, the public demand for "sustainable design" is quickly rising. In order to address this, Landscape Architects are implementing various "sustainable practices" in projects to mitigate their environmental impacts. To gain a better understanding of these trending practices, I conducted a brief survey among our UC Davis Landscape Architecture students. The survey asked four questions indicating the most popular products and practices of "sustainable design" and what it entails, ranking design elements and familiarity with sustainability ranking systems.

Question 1

What practices/products come to mind when you think of an environmentally sustainable site?

The intent of this question was to establish a baseline list of the main, trending practices in the field. The answers to this question could be comparable to the most popular buzzwords that are applied to sustainable building initiatives. Responses to were varied but some of the most prominent ones were the re-use of materials, on-site water management and renewable energy. A graphic representation of these eco-efficient buzzwords can be seen in Figure 2.1 on the following page. These general practices reflect a positive approach to sustainable site design, but many of the specific tools for implementation still fall short of success when they function alone and not as a greater designed system.

It is also interesting to note that the majority of these design practices and products are closely if not directly related to water. Although there are many different systems functioning on a site at any given moment, water is a very popular system for two reasons. First is the demand; with fresh water supplies dwindling, water is becoming a precious resource so there is a large public campaign to reduce water use. It is also a marketing opportunity for irrigation companies who are developing new technologies to accommodate for low water use and meet new legal restrictions on water used for irrigation. The second, and more inherent reason for a focus on water, is the simple fact that it is a tangible system. Site designers and users can see water flowing through a site and appreciate the sustainable efforts being made to manage water onsite or reduce water pollution.

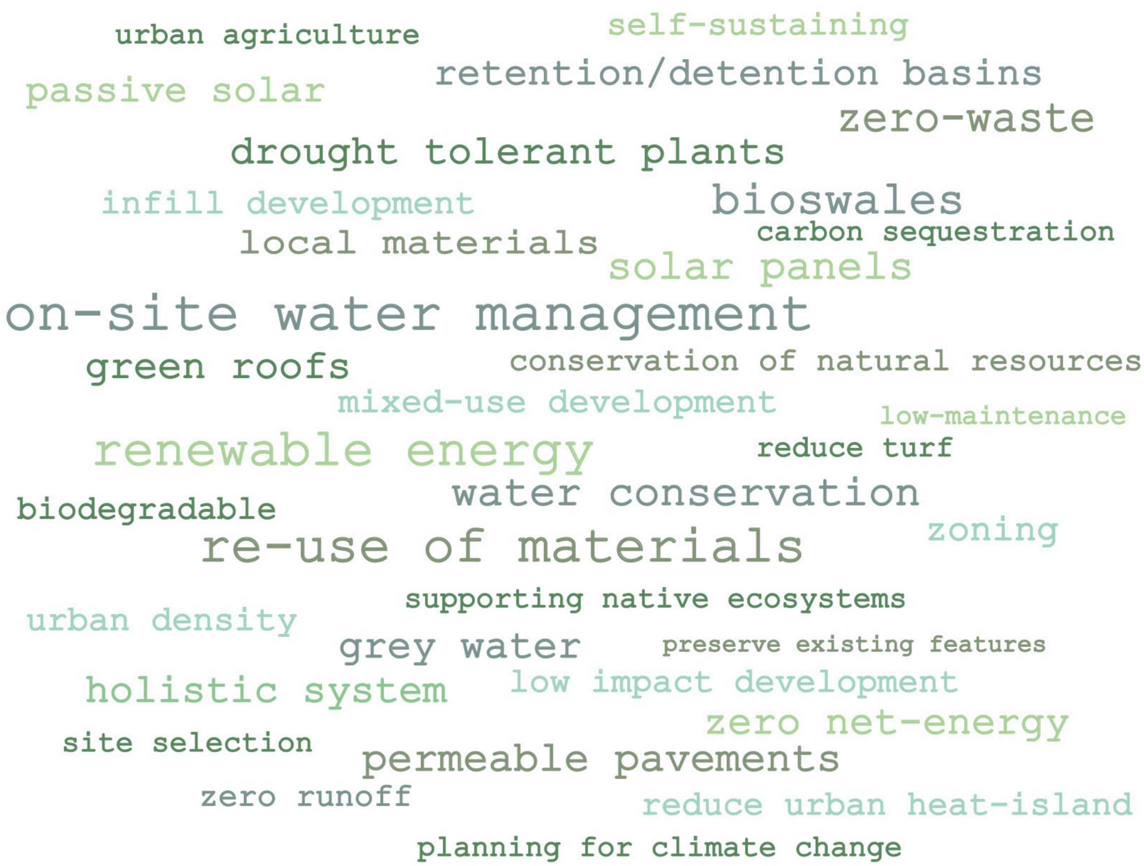

Figure 2.1 Eco-Efficient Buzz Words

In addition to the water-related practices highlighted by this survey, many students find materials to be an important component. Although this is another very tangible component of site design, these products potential risks. As Landscape Architects, we are not product designers nor chemists. With many proprietary claims over patented products, it is often difficult to obtain information regarding the exact composition of these materials. Permeable concrete, as on example, is often praised for its ability to reduce water runoff and allow rainwater to percolate back into the groundwater supply. Although benefit is a sustainable, there may be other functions at play that are not so easily seen or understood. Concrete in general is an extremely potent product that leaches chemicals into the soil. It is important to be aware of all implications of a product.

Question 2

In your opinion, what are the main elements of sustainable site design?

"Sensitivity to the needs of the users as well as the needs of the surrounding ecosystem."

"Integrates aesthetic, functional, and ecological appeals; long term use, low maintenance."

"Meets the needs of current users as well as future generation of users."

"Energy conservation. Water conservation."

"The fallacy that things will change."

"Sustainable site design should be integrated with its location and should be site specific. It should be able to last for a long time and adjust to the local conditions over time."

Opinions on this subject varied greatly. Some students appear to have a holistic approach when it comes to sustainability, but the majority of responses indicated focused practices of eco-efficiency.   It was also interesting to note the positive and negative undertones of some responses, which reflect a range of outlooks on "sustainability" as it is known in the field.

Question 3

Please rate these components of site design on a scale of 1-5, 1 being to most important to you as a Landscape Architect.

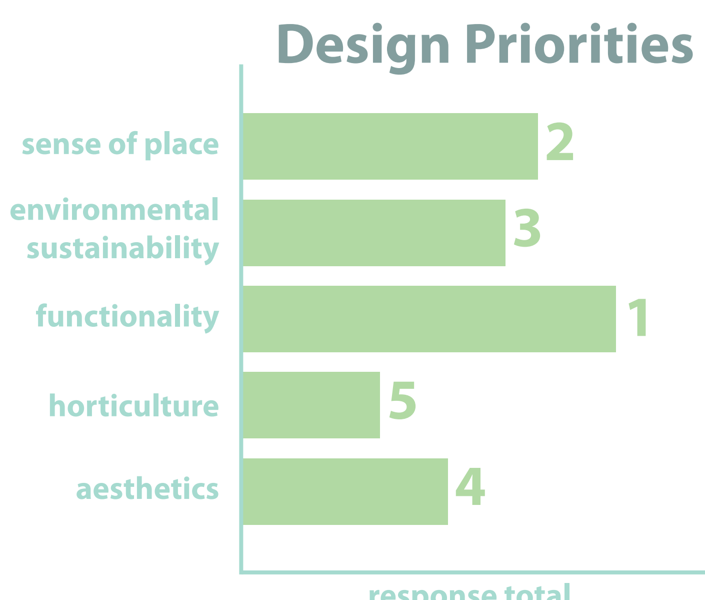

Figure 2.2 Design Priorities

As illustrated by these survey responses (Figure 2.2), environmental sustainability is not a priority in modern design. The reality of this can be seen in most built landscapes, which are functional for humans but neglect to establish positive interactions with the natural environment. Cradle to Cradle Design emphasizes the potential to integrate all of these design elements in a creative and revolutionary way. Re-thinking the way that built landscapes function will require a change in the mindset of designers, in which all site systems function as one unified ecosystem.

Question 4

Are you familiar the LEED and SITES programs? Do you understand their general purpose and procedures?

Leadership in Energy and Environmental Design (LEED) and the Sustainable Sites Initiative (SITES) are two rating systems for sustainable design, evaluating building design and landscape design respectively. These responses make it apparent just how prominent LEED has become, influencing designs in positive and negative ways, but we will get into that more later.

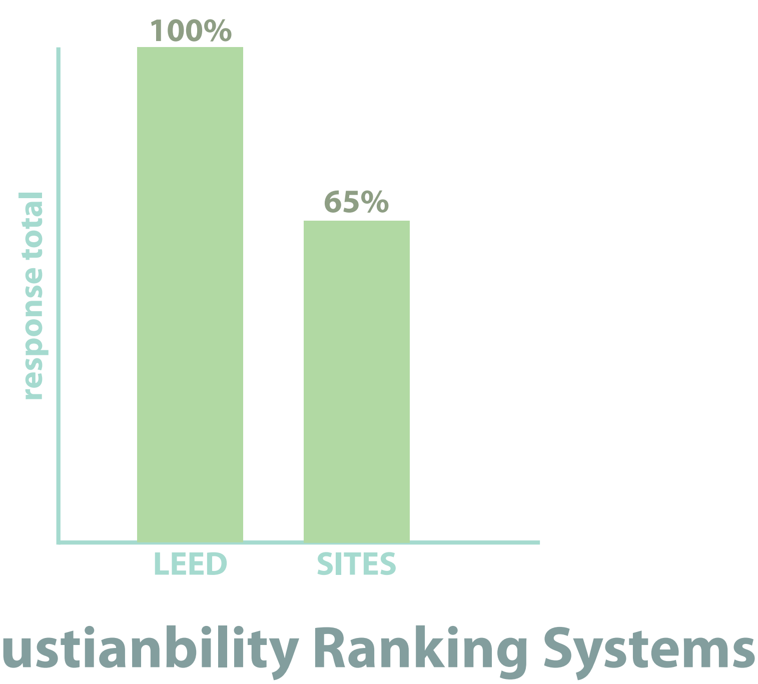

Figure 2.3 LEED vs SITES

Section III
Design Is Not A Checklist

Let me present a common scenario in the field of Landscape Architecture. A client initiates a project with intentions of attaining a “sustainable” or “environmentally friendly” site. Motivations for this decision can come from sincere desires to help the environment or simply for publicity reasons. Regardless of the reasoning, the client will approach the project with a certain set of pre-existing ideas and beliefs. Initial projections reflect other projects that have been praised for their progressive designs and may include such features as green roofs and photovoltaic cells, more commonly known as solar panels. Even before a Landscape Architect has been consulted, a client typically has some sort of a design in mind. Project designers then begin work with these initial expectations, becoming part of a project program that will greatly impact the resultant design and its priorities.

Next come the systems of certification. When dealing with LEED certification of a project, the design team of Landscape Architects, Architects and Engineers will often meet to review the requirements for whichever LEED certification level is desired, then literally divide up the checklist for each discipline group to achieve in isolation. It is commonly assumed that when all of these items are assembled in the final product, there will be a resultant “green building” (7Group and Reed, 12). At the end of the day, the project is hailed for being less harmful to the environment than a traditional design; the client is pleased; mission accomplished. As thousands of buildings are being designed every day with this approach, we find ourselves living in a world of less pollution, less destruction, less bad. Superficially this seems like progress, but the fundamental problems still exist and this eco-efficient mentality will simply not sustain our planet.

As Landscape Architects we are keen to meeting the desires and expectations of our clients, and although this practice has good reason, the design process can often be skewed by pre-imposed restrictions. When it comes to the environment, these fragmented design approaches are simply not effective. As John Lyle teaches in his writings, each and every site that we design will function as an ecosystem. The definition of an ecosystem, according to the Random House Dictionary, is “a system formed by the interaction of a community of organisms with their environment.” Examining the ecosystem of an estuary, we can see how numerous species, ranging from plankton to birds, function in harmony and all play a crucial role in a larger system of nutrient flows. In fact, the entire estuary its self becomes a sort of organism that functions as a large nutrient filter (Lyle, 173).

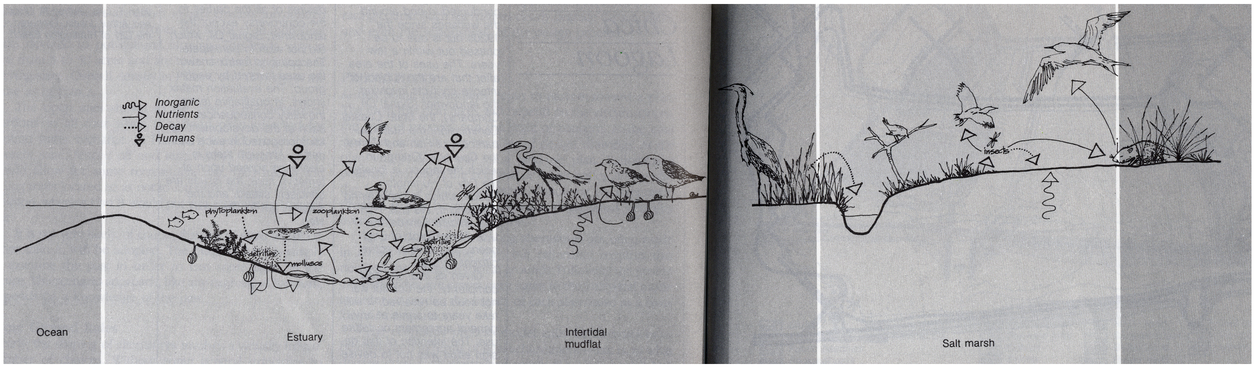

Figure 3.1 Estuarine Zones

In their very basis, these systems function as a complete circuit, and cannot be thought of or evaluated based on a checklist of components. In order to understand this concept better in the context of design, I will present a hypothetical site designed first from a checklist and then a systems approach. I will also examine three different sites in the Case Studies section and evaluate them based on the systems of water, nutrients and energy that function as a result of their design.

Checklist Design Scenario

When site design follows the pretenses that I previously described, the resultant design can be extremely fragmented in its efforts toward sustainability. The list of design elements illustrated in Figure 3.1 is based upon previous surveying and research into the growing trends of sustainability. These design components are each valuable in efforts toward sustainability, but only have the potential to be eco-efficient when applied independently, rather than in an eco-effective system. The following example demonstrates a typical implementation of individual sustainability features on a site without consideration of the larger systems they will function in. In this checklist style design scenario the nutrient, energy and water flows on the site directly reflect design decisions and are distinctly disjointed in their function.

Figure 3.2 Sustainability Checkpoints

In this hypothetical design scenario, there are bioswales, edible landscaping, photovoltaic cells, composting, a recycled graywater system, green roof, permeable paving, low-water irrigation and low voltage lighting options. These line items are also utilized in most of the case studies that I present of system based design. The capacity of their implementation and resultant effects will be very apparent through the system flow diagrams. Unfortunately, designers are often under the misconception that they can take this approach to design, in which the simply check items off a list of goals.

To illustrate these system functions I have created a series of diagrammatic flow diagrams that will appear throughout this thesis paper. These flow diagrams will be used to illustrate the basic pathways of the energy, nutrient and water systems that function on their respective sites, as a direct result of site design. The diagrams demonstrate the on-site flows as well as inputs and outputs that cross site-boundaries, indicated by the dashed line. These graphic representatives will make complex systems more easily understood and are a tangible method of evaluation for system-based design.

First, we will examine water flows of a typical checklist style design. In this scenario, runoff water is filtered and slowed as it runs through vegetative bioswales, but ultimately still flows off site through municipal storm lines and is dumped into the ocean or nearest waterway. Volumes of runoff water are mitigated through the use of permeable pavement options, but it important to be aware of the risks that this product raises. In addition to the toxins contained in concrete, permeable concrete also allows for pollutants to enter the groundwater supply if not implemented consciously. If placed in an area where toxins could be falling onto the pavement surface, water would carry them through the permeable material and into the earth below. This is just one example of how important context is in sustainable site design. Designers must be mindful of site uses and implications they will place on different systems.

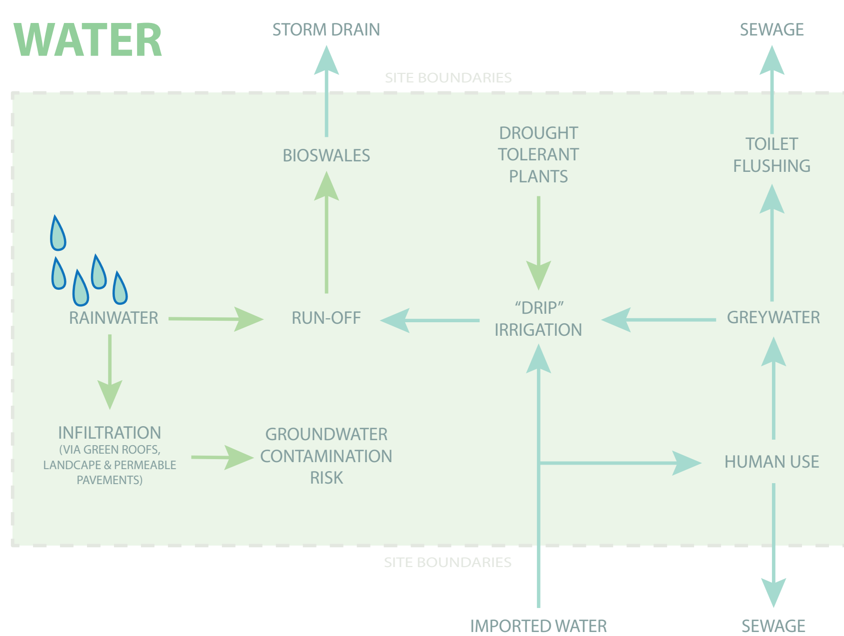

Figure 3.3 Typical Water Flows

In addition to natural rainfall, a typical planting palette will require supplemental irrigation. It is a common practice to utilize "drip irrigation" systems that emit low volumes of water and can be enhanced by integration with a graywater system. In this scenario, some water unused by humans, such as sink water, is reclaimed and used to irrigate landscape or in toilet flushing. These strategies reduce the volume of water that will need to be imported onto the site, but only by a small percentage. Amounts of sewage being deposited into the municipal lines will also be minimally reduced by these practices.

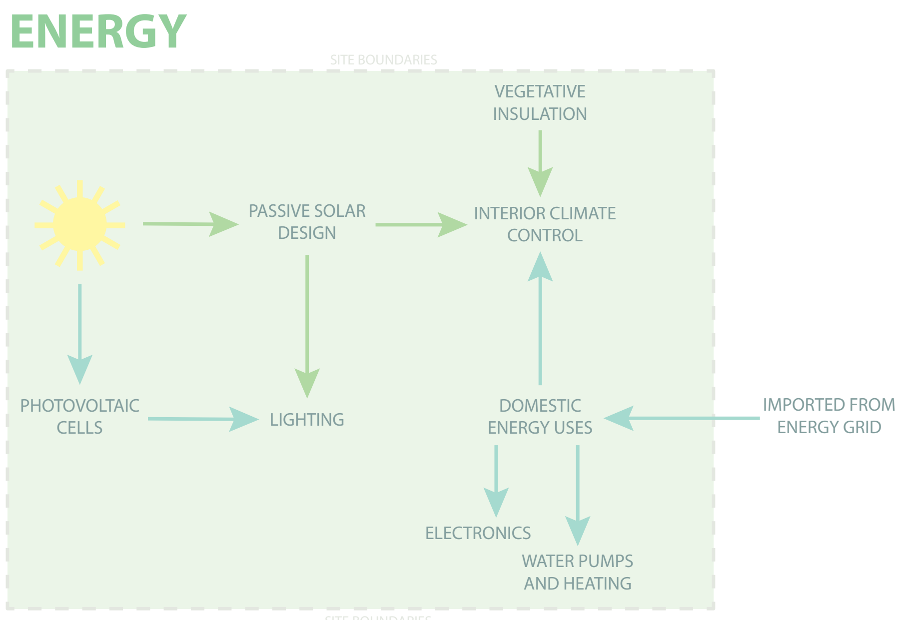

Figure 3.4 Typical Energy Flows

When examining energy flows on this cookie-cutter "sustainable site" we can see significant reductions in energy demands through the use of photovoltaic cells and passive solar design strategies, including natural lighting and vegetative insulation with windbreaks, green roofs and other landscape features. A significant amount of energy is still pulled from the grid for domestic uses, but energy demands for lighting have been mitigated through the photovoltaic arrays and natural lighting opportunities. These strategies do reduce energy demands, but an ideally designed system would not require energy to be imported onto the site, a process that is in itself wasteful as a large percentage of energy is lost during transportation.

Nutrient flows in this system are similarly disconnected. Edible landscaping provides some nutrition to site users and composting helps to sustain the edible plantings. Quantities of food waste are reduced, but the majority of foods are still imported onto the site with 100% of sewage flowing offsite to impact the surrounding environment.

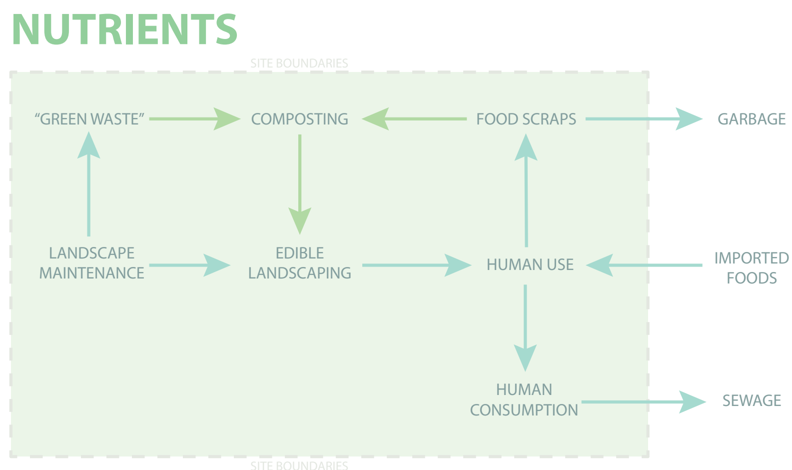

Figure 3.5 Typical Nutrient Flows

Although these design elements all have positive effects, they are clearly not functioning to their maximum potential. In the following section, I will present a series of three case studies that demonstrate a systems-based design approach. The three sites represent different scales of design: residential, small community and city district. Although they are not perfect, the thinking behind these designs is clearly effective in establishing coherent and naturally flowing systems.

Section IV

Case Studies of Systems-Based Design

The Coyote House
Montecito, CA

The Coyote House, as it has come to be called, is the work of a design power-couple. Architect, Ken Radtkey, and Landscape Architect, Susan Van Atta, collaborated on this project when their home in the Santa Barbara area was burnt to the ground in a forest fire (Preston). With a fresh slate, this dynamic duo set forth to create the most sustainable home that they could. The resultant design combines common practices with revolutionary new concepts and demonstrates a holistic approach to sustainable design.

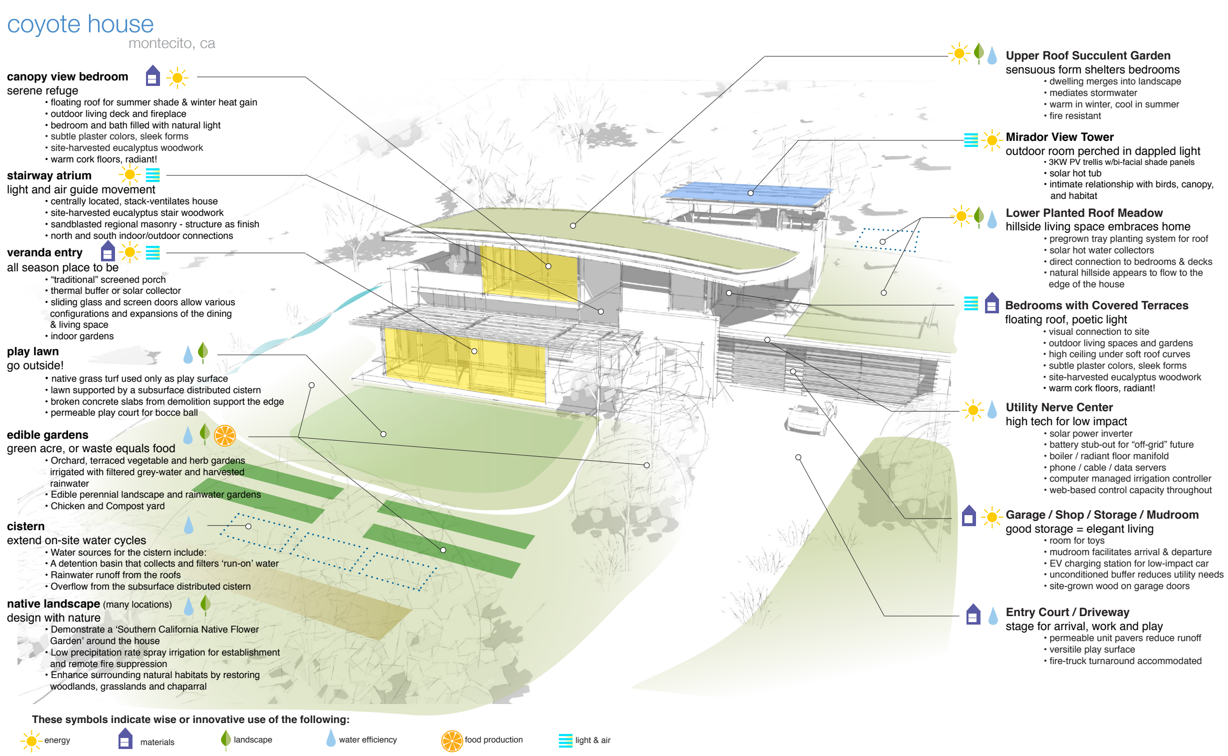

Figure 4.1 Coyote House Plan

The LEED Platinum certification of this site was the least of the couples' concerns as they evaluated their design from a systems perspective, going above and beyond the checklist requirements of a LEED certification. In their opinion, technology is too often used as a band-aid to sustainability rather than going back to the basis of design to resolve underlying issues. Radkley explains that the house is “a research avenue for [them]. [They] see it as a functional set of cycles, and the more of those you can get to work together, the more interesting the project.” He further emphasizes their goal to “keep it simple” in design, maximizing functions from their foundation. This project is extremely unique in the fact that the client and the designer are one in the same. There is no rush to conclusions and pressure to produce a design that meets and pre-existing notions. These two designers are also taking this chance to do experimental design in which they can test certain products or concepts without the restraints of a typical project. For example, the green roof on their home is irrigated half with drip irrigation and half with traditional overhead spray irrigation, to see which functions best.

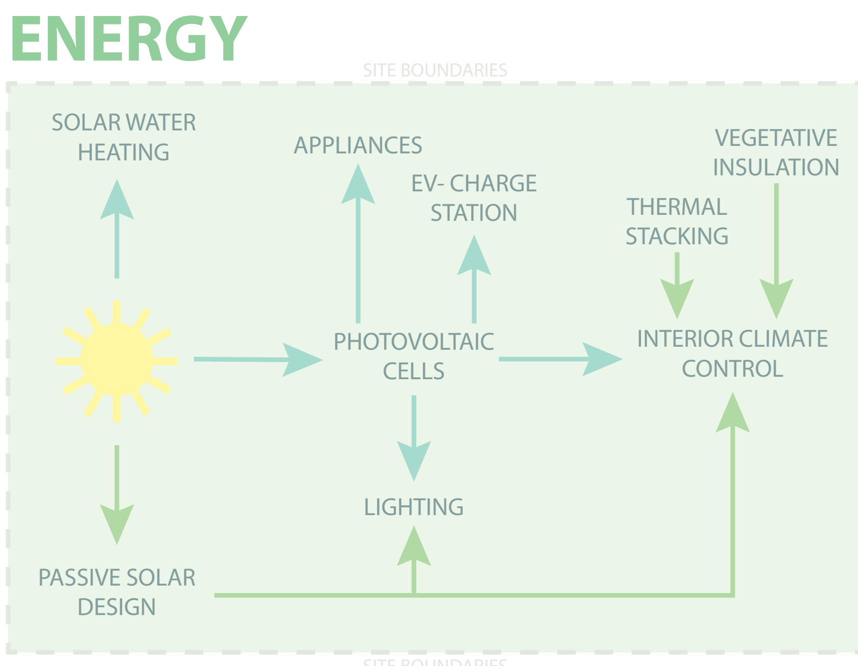

Figure 4.2 Coyote House Energy Flows

The home its self has become part of the hillside and maximizes passive solar opportunities as well as physical insulation from the land mass. This integration into the surrounding environment is also physically manifested in that the hillside literally slopes into the home, joining the natural landscape with the home’s green roofs, which are planted with strictly native species. The building’s configuration also allows for thermal stacking as a method of interior climate control. This site is integrated into the surrounding ecosystem in most every aspect. Green roofs aid serve not just in providing habitat, but also insulate the home and even act as a fire-resistant feature (Preston). Landscape Architect Van Atta explains that as far as the plant palette goes, "if it's not a native, locally adapted plant, then you can eat it" (Procopiou). The gardens contain a large portion of edible landscaping, such as fruit trees, herbs and artichokes. All plantings are strategically placed based on solar orientation and irrigation opportunities. Another innovative addition to the nutrient flows on the site is a chicken tractor, in which chickens are able to be re-located around the site to fertilize soils. There are also composting bins to fertilize the edible landscaping.

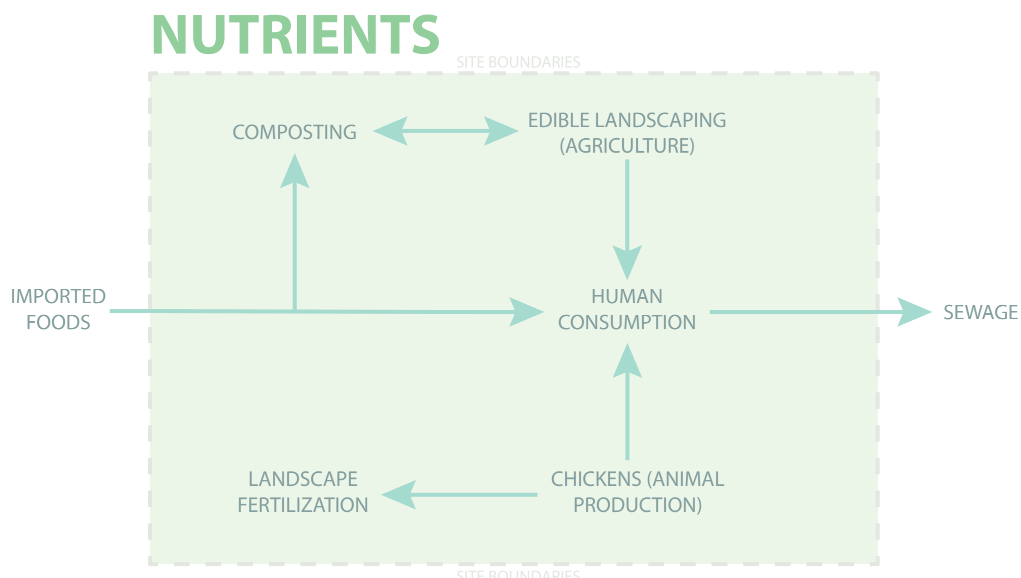

Figure 4.3 Coyote House Nutrient Flows

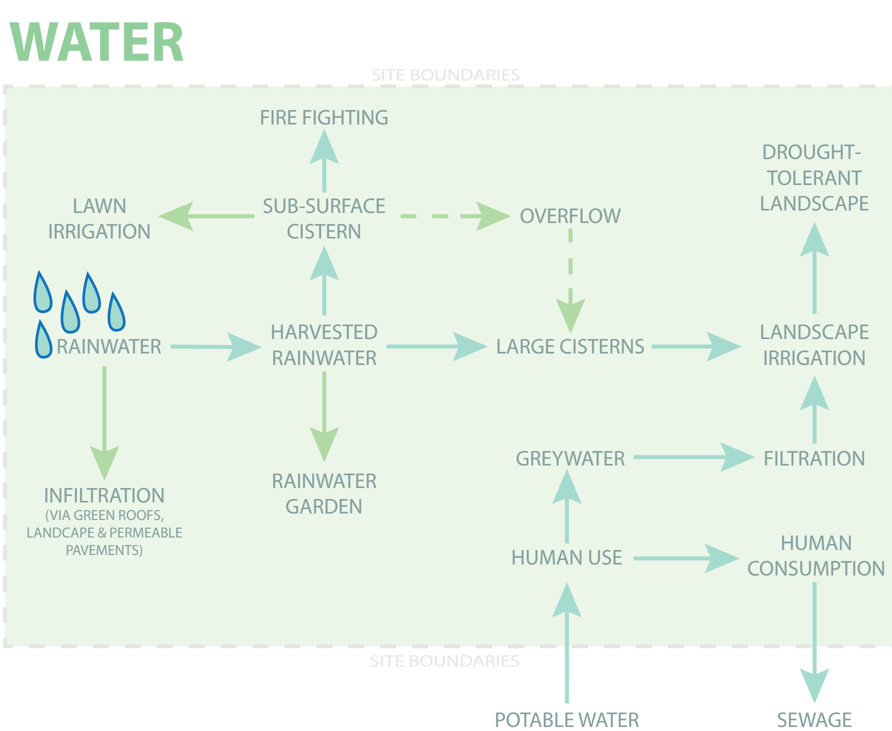

Figure 4.4 Coyote House Water Flows

Water systems on this site function with greats success. Rainwater is allowed to percolated back into the groundwater supply via permeable pavements and bioswales, with additional run-off water harvested into two cisterns. The first sub-surface retention site lays below the lawn, providing irrigation while maintaining an emergency water supply for fire fighting (Preston). When this cistern reaches capacity, water moves to the secondary cistern that provides water for irrigation. Additional irrigation water is obtained through graywater filtration system that re-claims a portion of the potable water not consumed in the home. Municipal lines still carry potable water onto this site and sewage away but overall the system demonstrates a highly progressive system in which demands and wastes are greatly reduced. It is a perfectly eco-effective design.

Rather than taking the traditional route and simply buying green products this design utilizes on-site resources. Wood used in doorframes and cabinetry comes from eucalyptus trees that were fire hazards on the site and sandstone was salvaged within the vicinity (Prococpiou). This home utilizes many cutting edge technologic features, many of which are all controlled by a master program on the home computer. Despite these many uses of technology, the main focus of design remains on simplicity. This is an ideal case of good design that is supplemented by good technology, rather than using the technology as a crutch. These two ambitious designers are using their experimental design to pave the way for future sustainable homes. Van Atta explains that " this house isn't about sacrifice, it's all about abundance. We want to build a more beautiful home that's more livable and more pleasing because it works with it's environment" (Preston).

"A connection to land and outside is essential. The more complex the interaction between a site's systems, the more rich the experience, and the more potentially sustainable and appropriate the project. Good design has a lot or performance benefits, but it is also experiential." Ken Radkley

University Village

Pomona, CA

A conceptual design by John, Lyle, the University Village development would be able to sustain a small student community, about 150 people on a little under 100 acres, using the resources available to them on the site to support the human ecosystem. Although it was not materialized, this plan is a powerful demonstration of design that is integrated into its surroundings and functions based on closed loop systems.

The basic site layout sets up the framework for this developed ecosystem, taking advantage of solar opportunities and sloping topography that will allow for gravity-powered irrigation techniques. The topographic orientations also serve to provide expansive views of the site from the most central structures, proving that elegance and ecology can work hand in hand with good design.

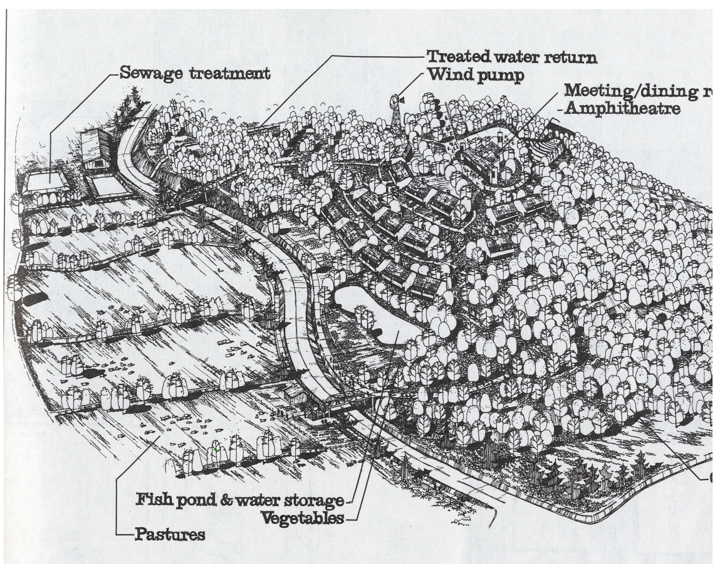

Figure 4.5 University Village Perspective Plan

As illustrated by this perspective sketch by Lyle, meeting and amphitheater structures sit atop the highest peak on the site with citrus groves strategically spanning the southern slopes for solar exposure, followed by vegetable gardens as the slope levels out and water begins to collect. An oxidative fishpond acts as a primary water treatment system and is elevated slightly above the vegetable plantings as to allow for gravitational irrigation. Wind-powered pumps move additional irrigation water uphill. Located across the road from the housing area are the pastures, livestock and sewage treatment facilities, which may not be ideal within close proximity of housing but are essential to a fully functioned system.

As Lyle so eloquently states, this design demonstrates a "highly functional approach, one that yields a site organization that expresses and reinforces inner workings of the man-made ecosystem." One other noteworthy point that Lyle makes in regards to this design is that complete seclusion is, in his opinion, not always the most efficient approach to sustainable design. Based on studies he conducted, Lyle believed that "self-sufficiency is probably not an economically efficient goal because it would inhibit making the best of landscape resources." His reasoning for this is based on the specialized features that make each individual landscape ideal for different uses. For example, the University Village site is ideal for citrus production and not as well suited for growing and harvesting grains. Thus, it is in the best economic interests of the community and the surrounding region to engage in commerce and exchange of goods. He then goes on to say that "some balance of self-support and trade is probably the most economically efficient goal." This concept can be directly related to the eco-effective fractal of cradle to cradle design.

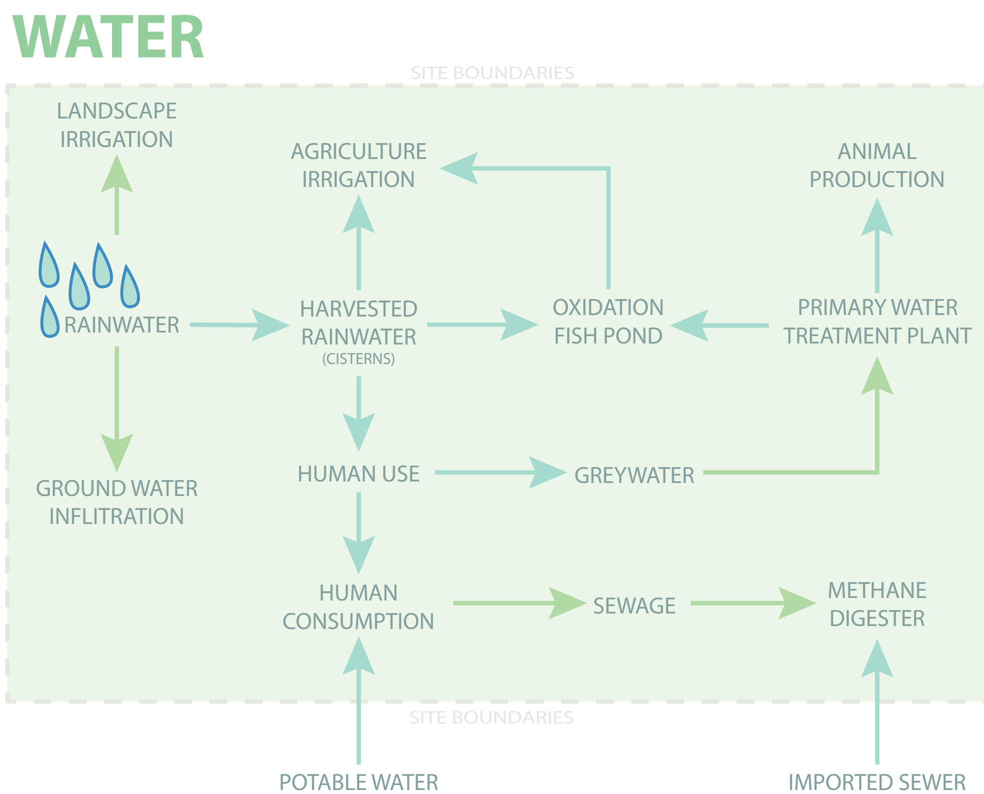

Figure 4.6 University Village Water Flows

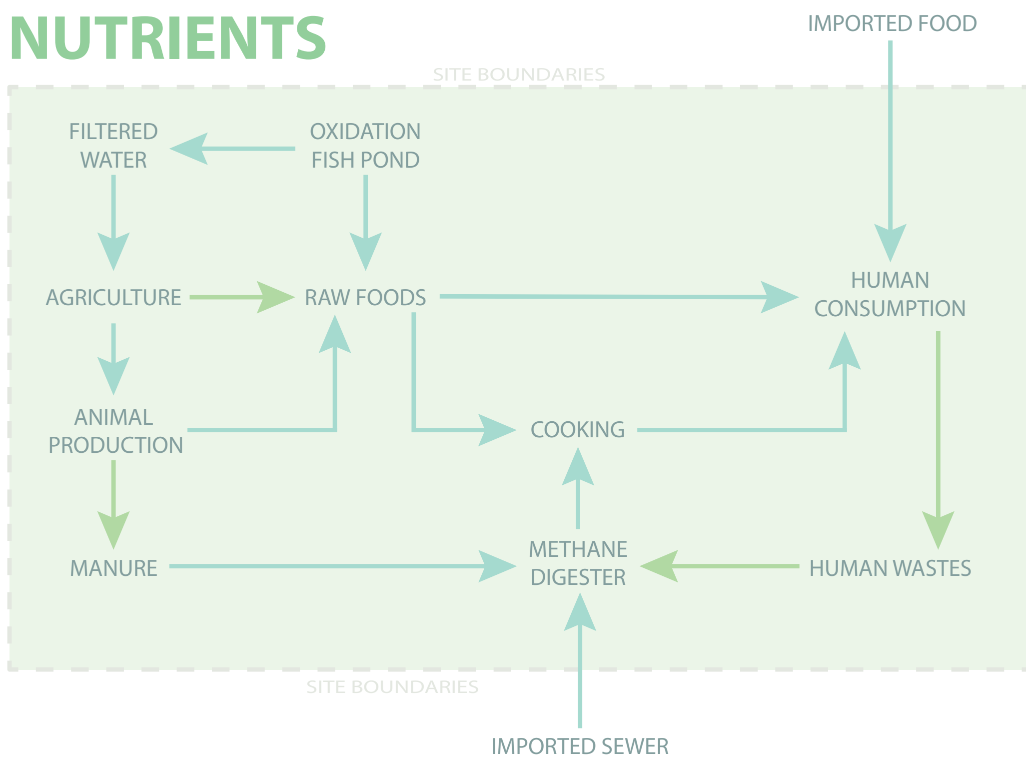

Figure 4.7 University Village Nutrient Flows

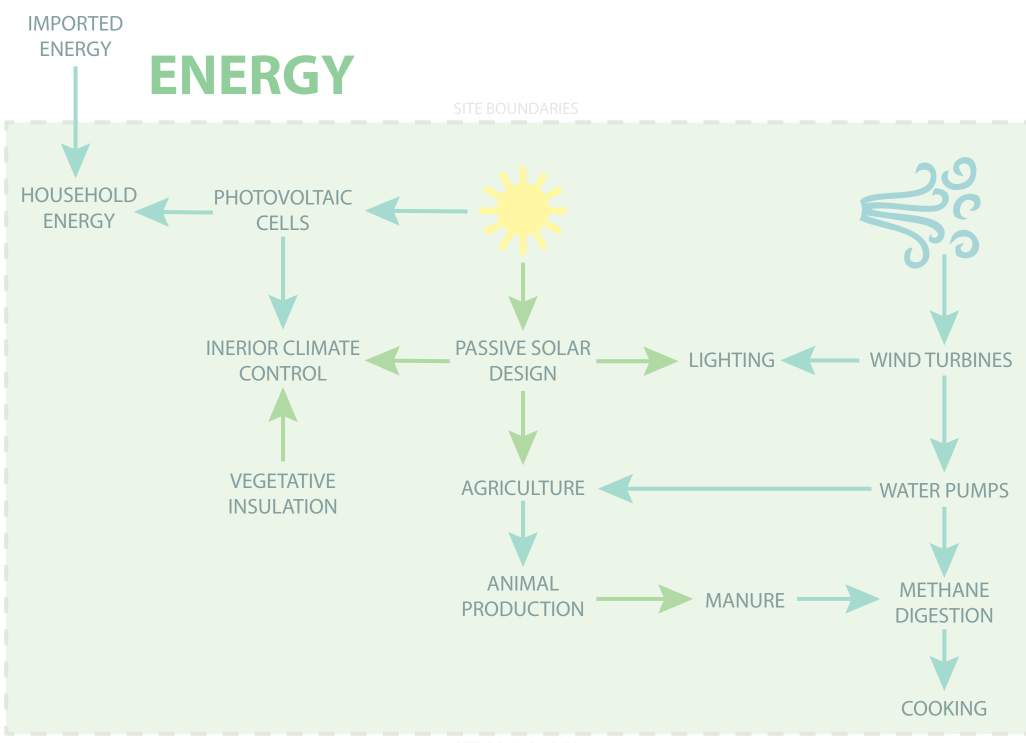

Figure 4.8 University Village Energy Flows

Park 20|20

Haarlemmermeer, Netherlands

This innovative business park development is breaking the mold of sustainable design as it aims to attain a revolutionary network of closed-loop systems. A so-called Cradle to Cradle Inspired Master Plan, the site is located near the Amsterdam Schiphol Airport in the Netherlands. Site design features re-circulated water supplies and on-site storm water management, renewable energy production, support of natural habitats and biodiversity as well as re-use of "wastes" on-site. By forming an integrated system, these elements also reduce carbon dioxide emissions and protect the regional water supply by reducing fresh water demands by 90% (MBDC).

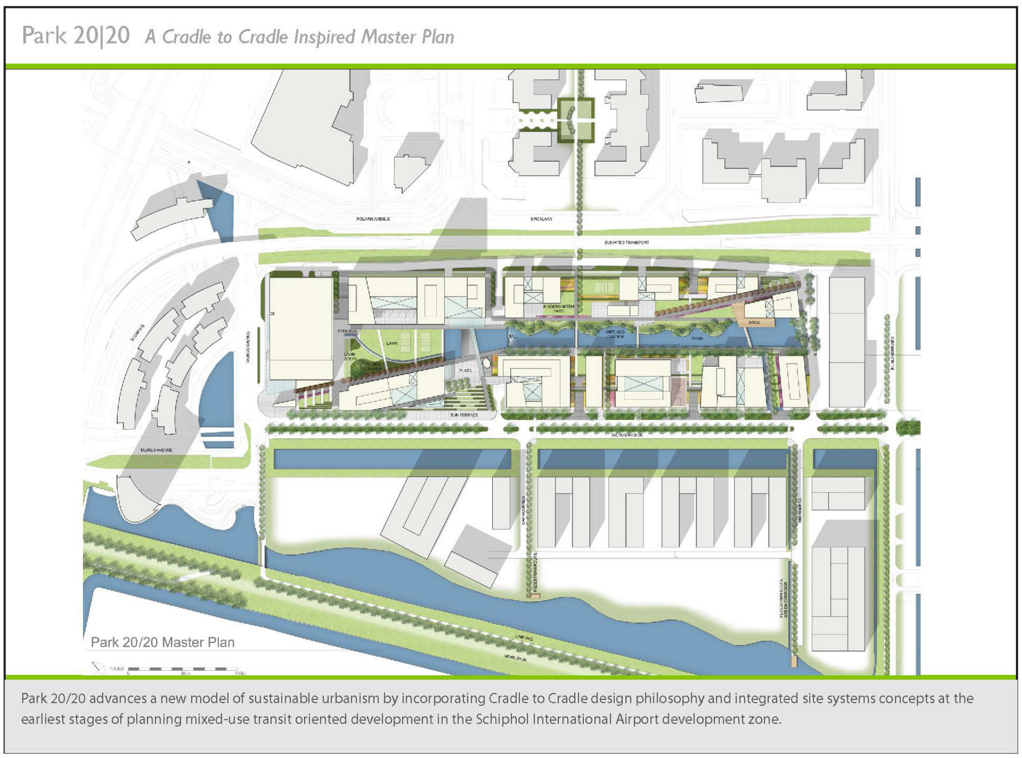

Figure 4.9 Park 20|20 Master Plan

Designers for this project are William McDonough + Partners in Architecture with Nelson Byrd Woltz as the Landscape Architects. These two groups have worked closely throughout the design process to ensure and integrated and holistically successful project. The site its self is unique in the fact that it is located on a "polder," land re-claimed from the sea (MBDC). These distinctive landscapes have a very specific set of opportunities and constraints. Particularly interesting is that there is no existing habitat established, another feature is the network of canals that run through the region, enclosed by a series of dikes and sea walls to prevent flooding in high tide or from sea level rise. A little over 28 acres in size, the development district includes a hotel, restaurants, retail shops and business offices.

Since this project was approached from a cradle to cradle perspective, the design is evaluated within the context of social, environmental and economic sustainability, the triple bottom line as McDonough and Braungart refer to it in Cradle To Cradle. Another goal of the project was to increase biodiversity to strengthen the ecosystem of the greater polder region (ASLA). Human health, connectivity and integration with public transportation were also key aspects of this plan. The framework form and layout of the site were determined based on the neighborhood's orthogonal orientation and additionally to maximize passive solar and wind opportunities that will contribute to building insulation and energy efficiency. Green roofs on all buildings go beyond traditional standards by creating a synergistic relationship between vegetative plantings and photovoltaic arrays, which provide shade for vegetation that creates a cooler microclimate and maximizes the energy yield of the photovoltaics (MBDC). The water circuits on this site are also extremely developed with fermentation and filtration techniques that yield clean water to be added to the greywater circuit as well as nutrients and biogas that is then used to power electricity turbines.

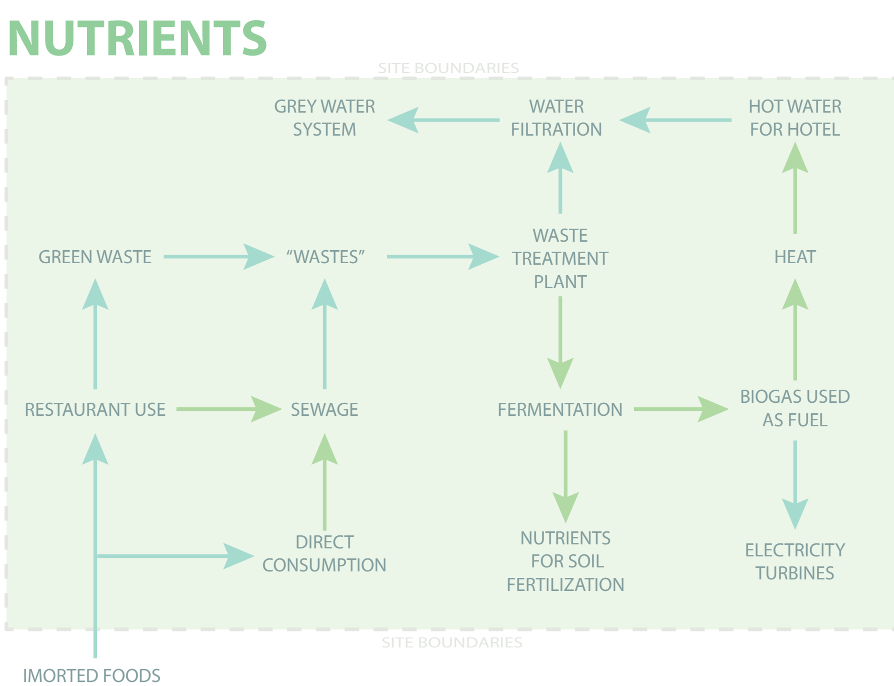

Figure 4.10 Park 20|20 Nutrient Flows

In looking at the systems diagrams for this design it is apparent that the systems function in nearly completely closed loops. Due to legalities, drinking water must still be imported onto the site, but zero waste leaves the site. The traditional "wastes" are rather re-used in an eco-effective cycle. Aside from potable water, food products are also imported onto this site. Although this input breaks the site boundaries, it was an informed design decision based on social, environmental and economic objectives. This site goes beyond reducing waste and toxins to actually eliminate the concept of waste, bringing materials from cradle back to cradle. Park 20/20 certainly sets a new standard for sustainable site design.

WATER

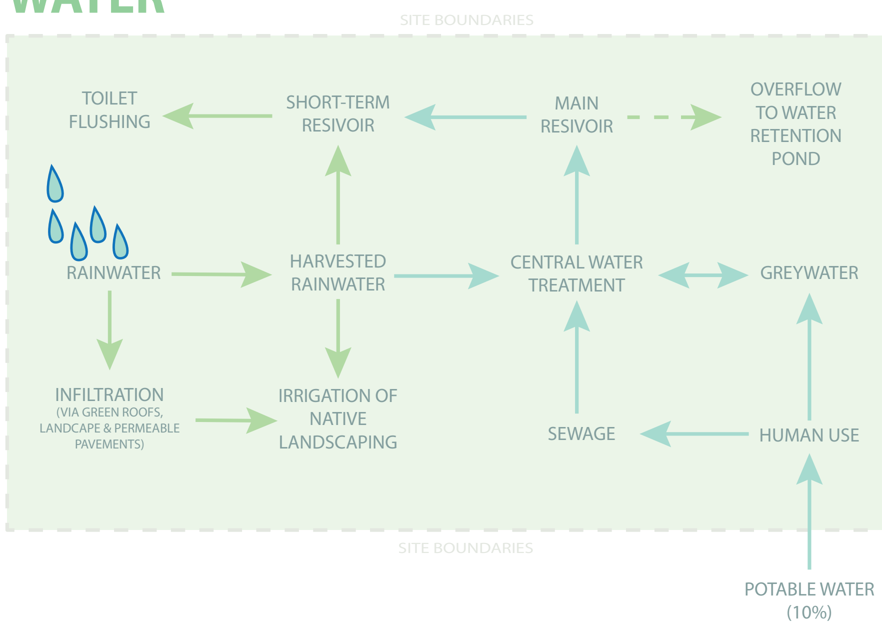

Figure 4.11
Park 20|20 Water Flows

ENERGY

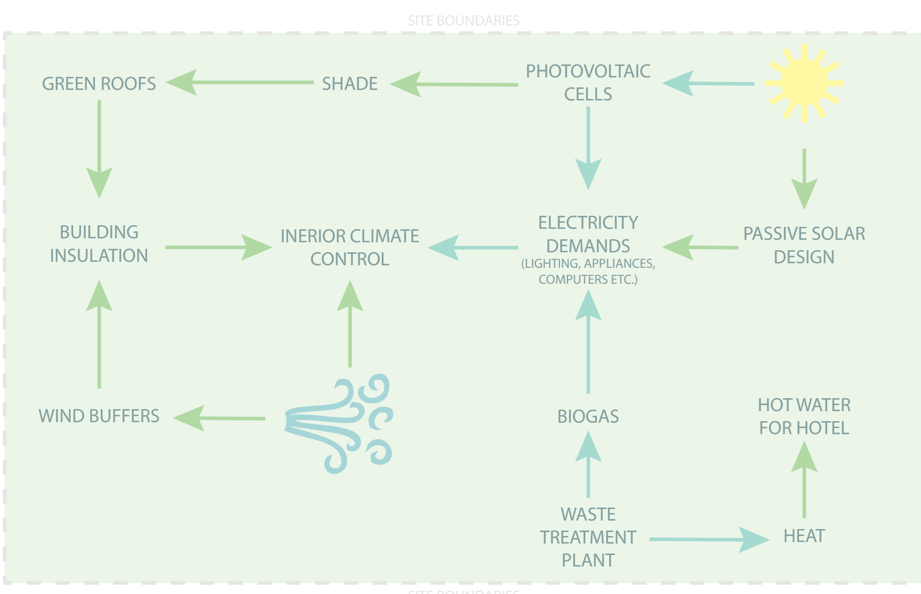

Figure 4.12
Park 20|20 Energy Flows

Section V
Rating Sustainability

The establishment of rating systems for sustainability has raised the standard for design in fields such as Architecture Landscape Architecture. These programs have helped facilitate what some consider a paradigm shift as we become more aware and focused on sustainable designs and construction practices. In this section I will be outlining and analyzing three of the most prominent sustainability benchmarks systems in the United States. All three of these examples have originated from different organizations and focus on different aspects of sustainability, but all have a common goal of reducing our negative impacts on the environment and establishing productive, symbiotic relationship between our society and the ecosystems in which we exist. Green buildings and sustainable landscapes are the future of development but regulatory systems and organizations will have a large influence on the pace at which we proceed with these practices as well as their success. The precedent that these rating systems set will be manifested in the built environment for decades to come.

LEED
Leadership in Energy and Environmental Design

One of the primary rating systems being utilized and discussed today was established by the US Green Building Council, a non-profit organization, in 1998 (Schwartz 2009). Leadership in Energy and Environmental Design, commonly known as LEED, ranks building projects upon a number of aspects encompassing design and building practices. This system is acknowledged at an international level and is quickly becoming a household term. LEED has become a prominent benchmark system that verifies "green buildings" on the basis of design, construction and operations. Certification systems vary from residential to commercial scales but include five main categories: sustainable site development, water savings, energy efficiency, material selection and indoor environmental quality (Taylor). One criteria is that a LEED accredited designer must be involved in the design in order to oversee sustainable practices and facilitate a process of design that is considers all facets of design

(D'Antonio). Verified "green buildings" are awarded a ranking of certified, silver, gold or platinum based upon the number of points accrued in the evaluation process (USGBC).

LEED has been extremely successful in defining a benchmark for green building by establishing quantifiable indicators and targets. By creating this system that praises and publicizes sustainable development practices, LEED has helped to raise public awareness and encourage competition within design professions. With a wide range of criteria, LEED attempts to evaluate buildings from a holistic approach but the basic framework of the rating system simply does not accommodate an evaluation of systems or their level of integration on a site. Aside from systems evaluations, LEED fails to consider the necessity of interdisciplinary interaction. Rather than encourage collaboration between the varying design professions, LEED in a way encourages their segregation by providing a checklist of items that each discipline can divide and approach individually. Furthermore, Landscape Architecture is largely neglected within the evaluation process.

The lack of a true landscape section and regional level of evaluation for LEED projects is a major flaw in this rating system. This problem has been partially mitigated with the introduction of the LEED Neighborhood Development system in LEED 2009, but this system only operates on a very large, urban scale and fails to examine the landscape in depth (Sustainable Sites Initiative).

One other large critique of the system is the financial burden that it places on designers and developers. Between a more detailed design, specific materials requirements and required collaboration with a LEED accredited designer, the project costs increase drastically. As many supporters will be quick to point out, the initial investment in LEED typically pays off in the long run through energy and water efficiency, incentive programs, publicity for LEED certified buildings and higher rates of employee productivity resulting from a healthy and accommodating work environment (Montoya). Although these are valid points, those benefits are more directly the result of sustainable design, with the exception of LEED specific publicity incentives.

Energy Star

Another prominent program has been Energy Star, a government project created by the US Department of Energy and Environmental Protection Agency in 1992 as a pioneer in sustainability rating systems (Energy Star). Most of the public is aware of the Energy Star campaign within the context of consumer products, but this program extends beyond this through partnerships with businesses and developers that provide tools and assistance in “measuring current energy performance, setting goals, tracking savings, and rewarding improvements” (Energy Star). In assessing the energy efficiency of a building, Energy Star compares the building side by side with similar buildings throughout the United States, focusing specifically on the energy intensity of the building (D’Antonio). Unlike LEED, this program is very focused on one characteristic of green building, energy efficiency. Energy Star programs and standards have been used in over 130,000 buildings throughout the United States, with 256 of those sites recognized through various Energy Star Awards (Energy Star). This figure may seem dwarfed when compared to the over thousands of homes and buildings that have received LEED accreditation, but it is important to note that this is one of many specialized programs run by the Environmental Protection Agency to reduce greenhouse gasses and promote green power sources, amongst other things (Timmer; Koch). The process of Energy Star accreditation and recognition varies greatly from that of LEED. With no distinctly defined point system with line items that are simply checked off during design, Energy Star simply provides the tools to reduce energy usage then evaluates the products and projects based on the net result of all energy efficient design elements (D’Antonio). In recent years, Energy Star has come under scrutiny for its evaluation process and inaccurate database information (Timmer). These problems pertained mainly to consumer product ratings but are relevant nonetheless to the reputation and competency of the Energy Star program.

SITES
Sustainable Sites Initiative

Still relatively fresh to the scene, the Sustainable Sites Initiative was introduced in 2005 as a joint effort between the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center and The US Botanic Garden (SITES). Although this system is still in pilot stages of establishment, it is making a strong impression and has already begun to raise the standards of sustainable design in the field of Landscape Architecture. The Sustainable Sites Initiative, referred to as SITES is intended to "promote sustainable land development and management practices that can apply to sites with and without buildings," (SITES) filling some of the gaps that still exist in the LEED rating system. Similar to the LEED system, SITES awards landscapes a point value based on standards of sustainable design, construction and maintenance (Schwartz). Various performance benchmarks help to guide professionals involved in the development and management of open spaces as well as building sites. Categories of evaluation range all the way from wastewater treatment to proximity to public transportation, creating an extremely comprehensive system of evaluation for the built landscape, the first of such landscape specific rating systems in the United States (Powers). As the Sustainable Sites Initiative works to establish its roots, there will be many challenges to overcome. One such challenge will be the gap between building and landscape that is now formally accentuated by the existence of two independent rating techniques, LEED and SITES.

Critique

Each of the three systems presented represents different issues in sustainable development and addresses the issues in varying ways. They achieve many positive goals, but as traditional rating systems, all three do present some significant drawbacks. Benefits for these programs include government incentives, increased awareness, reduced operational costs and the pure satisfaction of creating a sustainable building. When functioning in conjunction with one another, these systems also promote site development that is comprehensive and functions in unison. Government incentives such as expedited permitting and waived fees at the federal, state and local levels can be very persuasive for developers but are also dangerous since they encourage participation in these programs for financial and logistical reasons (Real Life LEED). Without full commitment to the values of sustainable development, developers may simply go through each line item of the rating systems and neglect to consider the overall product and impacts that the design may have on its surroundings. If the three programs, LEED, Energy Star and SITES existed, designers would be forced to evaluate the project on a more comprehensive and thorough level. It has been projected that at some time in the future the LEED and SITES initiatives will merge, as LEED is one of the primary stakeholders in the SITES program (SITES).

Going back to the work of John Lyle, it is simply not possible to create an environmentally sustainable site that is not integrated into the natural environment. Just as there is no cookie-cutter green building that can be stamped throughout the world, neglecting the landscape and regional ecosystem that surround a building is simply not an option when designing a human ecosystem. LEED incorporates the landscape at a very minimal level by encouraging vegetative buffers, green roofs and on-site water management strategies among a few other elements. Not only does this oversight downplay the importance of integrative design, it further reinforces a gap between “green buildings” and their ecological context.

Awareness at the professional and public levels is, in my opinion, the most significant of benefits from these sustainability rating systems. As the world becomes more aware of human relationships with the environment, topics like sustainable development have gained increasing consideration and exposure on the global forum. By promoting programs such as LEED, Energy Star and SITES the public will become aware of the high precedents being set in sustainable design and that precedent will eventually become the benchmark for all development. As general standards increase, I foresee that the standards currently set by independent programs like LEED and SITES will become government-mandated protocol for development. The US Green Building Council, ASLA and other independent stakeholders will continue to raise their standards as well. With always increasing technology, there will be new opportunities for sustainable development emerging for generations to come. With a high public awareness of the importance of sustainable development, these programs will retain their valuable functions of motivation and recognition for excellence in design.

In the professional world of Landscape Architecture, many designers regard LEED as a good benchmark, but recognize its shortfalls. Ken Radkley of Blackbird Architects Inc. explains that “LEED, as we see it, is an evolving points/checklist approach, and the first versions were rough guides to increase the projects’ performance and make them less toxic. The versions that have come along have been geared toward a whole systems approach and that’s where we’ve tried to be ahead of LEED” (Preston). To gain a better understanding of the general attitude toward I surveyed a few professionals myself. One notable response came from eco-enthusiast Josiah Cain, Landscape Architect at Design Ecology, who explains that sustainability ranking systems are “good metrics for ensuring we do the bare minimum to responsibly build. They are slowing down destructive practices, but not altering them.” Matt Durham of EPT Design, a Landscape Architect and LEED AP, also acknowledges the potential for these systems to influence the way designers think and work. He also points out that “These systems help create even more research into the materials we select and implement into a design.”

Although these rating systems are promoting the most sustainable approaches to design, they are successful in many other aspects. Perhaps they can evolve with the profession to accommodate for a more systematic evaluation of site design.

Conclusion

Bridging The Gap: Strategies For Change

Cradle to Cradle Design is simply one specialized practice of a more general systems approach to design. In this section I will clearly outline the strategies and ideas presented by these progressive systems of design. These central principles, methods and tools embody the ideals of McDonough and Braungart, John Lyle, and many other design philosophers.

The cradle to cradle model is often criticized for being too far-fetched and unrealistic, but this has been clearly contradicted by the preceding case studies as well as many other designs by groups like McDonough Braungart Design Chemistry (MBDC). The answers to sustainability are not all be at our fingertips, but they are attainable and they are embedded in the fundamental functions of nature. By actively designing systems to function with the natural environment, we can work as a profession toward increasingly resilient designs. One of the most exciting aspects of this design approach is the abundance that it makes possible by maximizing natural systems and drawing from the power of the earth. In the introduction to Design With Human Ecosystems, Joan Woodward explains that "Professions mature when a new paradigm appears to interpret pre existing knowledge differently and address a growing need." Systematic approaches to design, such as the cradle to cradle model, certainly demonstrate a different interpretation of knowledge than traditional, linear approaches to design. The intent of this following section is to facilitate a shift in thinking. It is time that Landcsape Architects all work collectively to create ntegrative, systems-based designs that accommodate for zero waste, nourish the environment and fosters a healthy, symbiotic relationship between humans and the ecosystem.

"We realize that design is a signal of intention, but it also has to occur within a world… we, in a way, need to go to the primordial condition to understand the operating system and the frame conditions of a planet, and I think the exciting part of that is the good news that's there, because the news is the news of abundance." -William McDonough

Guiding Principles for a Paradigm Shift in Design

1. Holistic Vision

Take a holistic view is an imperative principle to ecological design. Methods of holistic design vary but all contribute to a higher level of thinking.

2.Concsiously Designing Ecosystems

Be conscious of the ecosystem that will be formed as a result of each design decision you make. By thinking of design decisions in terms of their implications on the ecosystem, we can develop highly functional systems that maximize potentials and function harmoniously. As Lyle taught, ecological design is "the art of arranging an external physical environment in complete detail" (Lyle, 102).

3. Designs As A Signal Of Intention

Embrace design as a signal of intention is also crucial to designing sustainably. Just by acknowledging this fact, we can challenge ourselves as designers to create sites and systems that embody positive environmental intentions.

4. Operate on the foundations of a "triple top line"

Consider Social, Environmental and Economic objectives while making informed design decisions. This "triple top line," as McDonough and Braungart refer to it, ensures an equitable balance between ecological aspects of design and their relation to humanity, rather than focusing exclusively on financial implications of design, as is common practice for many projects today.

5. Persistence

Continually innovate, challenge ideas and actively DESIGN. Design of any kind is a dynamic process in which revision, adaption and refinement are constantly operating, complementing the dynamic nature of ecosystems. With eco-effective design there will never be one conclusion to reach. As natural systems fluctuate, technology progresses and human culture progresses new methods of design and revolutionary techniques will prompt changes in design.

> "You know you are on the right track when your solution for one problem accidentally solves the others." Michael Corbett, Village Homes

Methods Of Approach

1. Building Organisms

This specific method is commonly referred to as biomimicry. When designing details it can become difficult to realize how they will function in the larger system. By breaking down pieces of a design into smaller elements, like a building, it is more manageable to create that entity as an organism that will then operate in within the grater systems.

2. Interdisciplinary Collaboration

Design of any site requires the exchange of information between varying disciplines, including but not limited to Architects, Landscape Architects, Engineers, and Interior Designers. Although a certain degree of communication is inherent in a project, the level of integration between these components of site structure plays a vital role in the function of the overall systems operating on the site.

3. Solving For Pattern

Design within a system of patterns ensures coherence between different levels of context. As Wendell Berry explains in Solving for Pattern, “It is the nature of any organic pattern to be contained within a larger one. And so a good solution in one pattern preserves the integrity of the pattern that contains it.” All ecological design is contextual, with the pattern approach to integration, those connections become more tangible and easily organized.

4. Informed Planning

It is important to acknowledge that the practice of ecological design exists on a dramatic learning curve. There are still many unknown factors in all fields of design, including Landscape Architecture. As we work to define and develop eco-effective components for design, we must do the best with what we have available to us. By making informed decisions that consider the triple-top-line. Although this is an eco-efficient approach rather than an eco-effective one, it is sometimes the best option we have and is certainly better than neglecting the environment all together.

5. Trial and Error

Lyle uses the diagram represented in Figure 6.1 to illustrate the process of proposal and disposal of ideas that occurs throughout an effective design process.

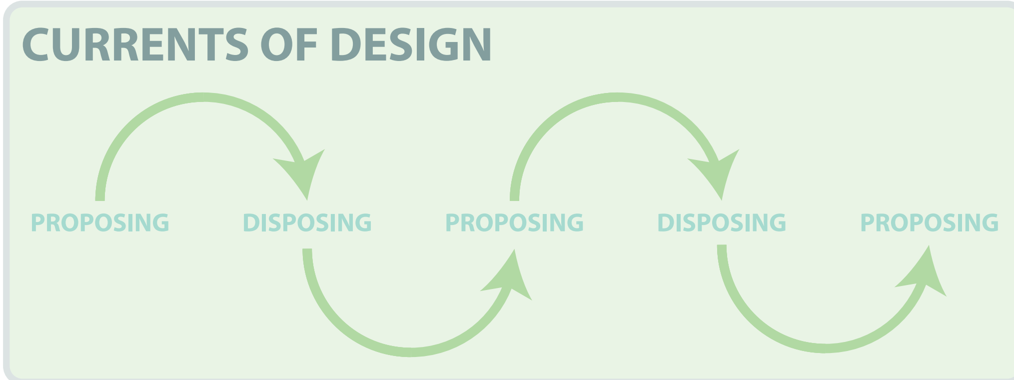

Figure 6.1 Currents Of Design

A similar process can be observed in the context of evolution as ecosystems progress and thrive. In designing human ecosystems we must be open to feedback and explore a range of alternatives so that we may find form a system that functions with the highest productivity, economically, ecologically and socially.

6. Re-invent The Wheel

At some point, we must break away from the eco-efficient framework that governs modern design and re-write the script. This revolutionary design will require creativity and ingenuity, following the example of natural systems to sustain our human ecosystem.

Tools For Implementation

1. Eco-Effective Fractal

This tool, seen in Figure 6.2, illustrates the three main objectives of Cradle To Cradle Design: equity, ecology and economy. This diagrammatic tool helps make the relationships between each objective tangible and can facilitate a positive balance of design intentions. A fractal, by definition, is a form that is applicable to any scale and consists of a series of self-similar parts, implying an inherent balance between points.

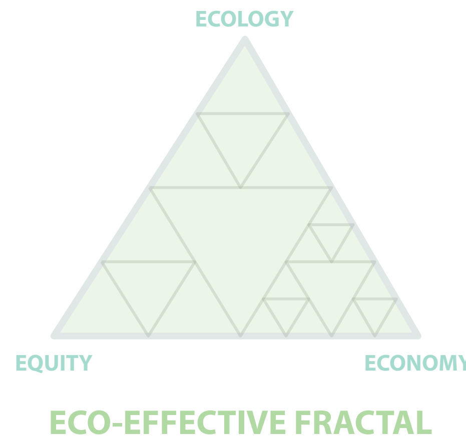

Figure 6.2 Eco-Effective Fractal

2. Nature as a Model

Infrastructure that conflicts with nature is simply illogical and dysfunctional. By using nature as a model for design, we can maximize effectiveness of the systems and utilize the power of nature to our advantage, rather than exerting immense forces to contain it.

3. Technology as a Privilege

Technology will perpetually advance, but it is important to recognize these innovations as a privilege in design, not as a crutch to lean on. Technologies can be developed for specific uses in human ecosystems, but it is vital to first lay systematic framework that functions with the natural environment.

4. Models

Models, such as they system flow diagrams that I have used throughout this project, are a powerful tool in making system functions tangible. As John Lyle explains, “A model in [a] broad sense is simply an abstract representation of reality” (Lyle, 129). Models not only make conceptual relationships more tangible but also help designers to realize the bigger picture, and possible gaps that exist in designed systems.

5. Context

All scales are relative. West Churchman, author of Systems Approach and Its Enemies, so eloquently states that the systems approach is "based on the fundamental principle that all aspects of the human world should be tied together in one grand rational scheme." Context can also serve as a basis for design. By understanding the larger systems that a site functions within, design requirements will be rather obvious.

6. Feedback

Feedback is natural, and valuable in design. Feedback from natural systems can provide insight that may not have been apparent previously. Designs will often require adjustments over time. The design currents created by feedback will help to shape this natural progression of design.

> "This is going to take us all,
> and it's going to take forever.
> But then, that's the point."
>
> -William McDonough and Michael Braungart

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Cradle To Cradle To Landscape Architecture

A Senior Project presented to the Faculty of the Landscape Architecture Program at the University of California, Davis. This project fulfills requirements for the degree of Bachelors of Science in Landscape Architecture.

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