

AET 3833

Sustainable Buildings

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Lecture 3

Ecological Design



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Design versus Ecological Design

1. Understanding ecology and its applicability to the built environment.
2. Determining how to use nature as the model and/or metaphor for design.
3. Coping with an industrial production system that operates using conventional thinking.
4. Reversing at least two centuries of design that used the machine as its model and metaphor.

Benefits of Sustainable Design

Siting

Economic – Reduced costs for Site Preparation, Parking Lots and Roads.

Societal – Improved aesthetics, more transportation options for employees

Environmental – Land preservation, reduced resource use, soil and water conservation

Benefits of Sustainable Design

Economic, Societal, and Environmental

Water Efficiency

Energy Efficiency

Materials and Resources

Indoor Environmental Quality

Building Operations and Maintenance

Bases for Ecological Design as Suggested by Yeang

1. Design must be integrated not only with the environment, but with ecosystems that are present.
2. Because Earth is a closed system, matter, energy and ecosystems must be conserved and the biosphere's waste assimilation must be considered.
3. The context of the ecosystem, that is, its relationship with other ecosystems must be considered.
4. Designers must analyze and use each site for its physical and natural structures to optimize the design.
5. The impact of the design must be considered over its entire life cycle.
6. Buildings displace ecosystems, and the matter-energy impacts must be considered.
7. Due to the complex impacts of built environments on nature, design must be approached holistically rather than in a fragmented manner.
8. The limited assimilative capacity of ecosystems for human-induced waste must be factored into the design.
9. Design should be responsive and anticipatory, and as much as possible result in beneficial effects for natural systems.

Implementation of Ecological Design by Yeang

- 1. Define the building program as an ecological impact statement (analysis).**
- 2. Produce a design solution that comes to grips with the probable environmental interactions (synthesis).**
- 3. Establish the performance of the design solution by measuring inputs and outputs throughout the life cycle.**

Ecological Design: Sim Van der Ryn and Stuart Cowan

1. Solutions grow from place.
2. Ecological accounting informs design.
3. Design with nature.
4. Everyone is a designer.
5. Make nature visible.

General Rules for Sustainability

- 1. The use of renewable resources should not exceed the regeneration rate.**
- 2. Nonrenewable resources may be used only if physical or functional substitutes are provided.**
- 3. Waste matter should not exceed the absorption capacity of nature.**

Golden Rules for Ecodesign

- 1. Potential impacts to the environment should be considered on a life-cycle basis (from cradle to cradle).**
- 2. The intensity of use of processes, products, and services should be maximized.**
- 3. The intensity of resource use (material, energy, land) should be minimized.**
- 4. Hazardous materials should be eliminated.**
- 5. Resource input should be shifted toward renewables.**

Biomimicry

1. Use waste as a resource.
2. Diversify and cooperate to fully use the habitat.
3. Gather and use energy efficiently.
4. Optimize rather than maximize.
5. Use materials sparingly.
6. Don't foul the nest.
7. Don't draw down resources.
8. Remain in balance with the biosphere.
9. Run on information.
10. Shop locally

Cradle to Cradle Design

- 1. Buildings, like trees, produce more energy than they consume and purify their own wastewater.**
- 2. Factories produce effluents that can be used as drinking water.**
- 3. Products when their useful life is over do not become useless waste.**
- 4. Accrue materials from natural process within the building through natural purposes.**
- 5. Buildings which provide a world of abundance not one of limits, pollution, and waste.**

Limits on Recycling Materials – Mindset Shifts

- **Shift 1 – Radical Resource Productivity**
- **Shift 2 – Ecological Redesign**
- **Shift 3 - Service and Economy Flow**
- **Shift 4 – Investment in Natural Capital**

What Does Ethics Mean?

Dictionary:

“A discipline dealing with what is good and bad, with moral duty and obligation”

Methods for Society to Encourage Correct Decisions

- Laws (codes)
- Enforcement (courts)
- Political (diplomacy)
- Economic (boycott)
- Military(force)
- Ethics is the preferable way society can achieve the “right” decisions without having to use:
 - codes
 - courts
 - diplomacy
 - boycott
 - military

Why Talk About Ethics?

- A sense of right and wrong has to be built into every level of society:
 - individual
 - community
 - business
 - nation
 - globe

What are the Human Commons?

1. Historical and abandoned commons

- Land for food gathering, pasture, hunting and mining
- rivers and streams for fishing and water use

2. Partially abandoned commons

- Land, rivers and ocean for various waste disposals
- Oceans for fishing
- Sound waves

Historical View of Land

- Indigenous people: Land is part of a living being (Gaia, Mother Earth)
- Europeans: Nature was considered passive relative to human (male) activities and associated with the female.
- Today's Dominant Culture: Land in its natural state is considered undeveloped and unproductive

The Tragedy of the Commons

- Resources (taking things from the commons)
- Pollution (putting things in the commons)
- Legislative set-up and feedback (how to supervise needed authority and install corrective feedbacks)

The Two Main Sustainability and Ethical Issues

- Overpopulation
- Preoccupation with possession, power and ambition

Why do we feel we need more stuff

- Status
- Missing non-material goals and spiritual values in life
- Disconnection of humans from the natural world
- media manipulation

Could Technological and Legal Fixes Make Sustainable Ethics Unnecessary?

A. Population Growth:

- Forced sterilization and other methods of birth control have not worked
- Taxation or loss of subsidies had moderate success
- Economic growth had moderate success

B. Consumption

- taxes are partially effective (petroleum price in Europe vs. USA)
- some business are in the process of changing their business goals from making profit for any price to becoming a responsible player together with government, communities and environment.

Statement by Author: Many initiatives towards sustainability are currently undermined by seemingly overwhelming economic global forces of liberalization, deregulation and homogenization.

Can we fix our ecological and social problems by a spiritual approach?

- Living in closer intimacy to the natural world
- Being more aware of our kinship and interdependence to nature
- Emphasizing within our churches the primary manifestation of the divine in the natural world and de-emphasize the view that we are “only passing through”.
- Abandoning our anthropocentric view of the world

Opposing Ethical View Points

- Deep Ecology
- Anthropocentric Ethic

Deep Ecology

Ecological ethics is an expansion of our anthropocentric ethics

1. The well-being and flourishing of human and nonhuman life on earth have value in themselves. These values are independent of the usefulness of the nonhuman world for human purposes.
2. Richness and diversity of life forms contribute to the realization of these values and are also values in themselves.

Deep Ecology

3. Humans have no right to reduce this richness and diversity except to satisfy vital needs.
4. The flourishing of human life and cultures is compatible with a substantial decrease of the human niche, effected either by a reduction in population or in per capita resource consumption. The flourishing of nonhuman life requires such a decrease.
5. Present human interference with the nonhuman world is excessive, and the situation is rapidly worsening.
6. Policies must therefore be changed. These policies affect basic economic, technological, and ideological structures.

Deep Ecology

7. The ideological change is mainly that of appreciating life quality rather than adhering to an increasingly higher standard of living.
8. Those who subscribe to the foregoing points have an obligation directly or indirectly to try to implement the necessary changes (Devall and Session)

Ecological Ethics

- Something is “right” when it tends to preserve the integrity, stability, and beauty of the biotic community; it is wrong when it does otherwise.
(Leopold, 1966)

Anthropocentric Ethic

- Humans are not part of the natural world but more like God.
- The value of the non-human world is to be used by humans for their necessities, comfort and convenience.
- The natural world is threatening to humans and must be controlled

How Could “It” Work

- Adopt an “sustainable ethic”
 - personally
 - within a community
 - within a country
 - Internationally
- Adopt a set of values (e.g. Deep Ecology)
- Apply these sets of values in once personal, professional and civic life
- Re-connect emotionally to the natural world
- Live simply so others may simply live
- Welcome opportunity to conserve the earth’s resources
- Work in multi-stakeholder groups for an alternative local economy and community

Business

- Determine the moral responsibilities to other life forms in our economic activities.
- Define an universal business ethic
- Companies should adopt and live by a set of principles such as Valdez, Hannover, Copernicus, Natural Step)
- Make the transition from an extractive economy to an organic economy.
- Increase efficiency (Factor 10) and design for zero discharge.

Community, Nation and International

- Incorporate our moral concept of justice applicable to human interaction with non-human life forms and their eco-system.
- Change justice system to protect the natural world besides guaranteeing democracy, individual freedom and rights to property
- Institute multi-stakeholder groups for an alternative local economy and community

Green Building Decisions

- Impacts on climate change: selection of energy systems; planning; transit; fostering bicycling
- Dwindling resources: fossil fuels, metals, potable water
- Impacts on natural systems: construction process; building location; product manufacturing
- Buildings as resources for future generations
- As in other sectors, it comes down to ethics

Ten Ethical Principles Underpinning Sustainability

1. Intergenerational Justice and the Chain of Obligation
2. Distributional Equity
3. The Precautionary Principle
4. The Reversibility Principle
5. The Polluter Pays Principle
6. Protecting the Vulnerable
7. Rights of the Non-Human World
8. Respect for Nature
9. The Land Ethic
10. Sustainable Decisionmaking versus Once-Off Decisionmaking

Intergenerational Justice and the Chain of Obligation

- The choices of today's generations will directly affect the quantity of resources remaining for future inhabitants of Earth, and will affect environmental quality.
- This concept of obligation that crosses temporal boundaries is referred to as *intergenerational justice*.
- Furthermore, the concept of intergenerational justice implies a *chain of obligation* between generations that extends from today into the distant future.
- Parental responsibility for enabling their offspring to meet their moral obligations to their children and beyond.

Distributional Equity

- There is an obligation to insure the fair distribution of resources among present people so that the life prospects of all people are addressed.
- Based on principles of justice and the reasonable assumption that all individuals in a given generation are equal and a uniform distribution of resources must be a consequence of intragenerational equity
- The principle of distributional equity can be extended to relationships between generations because a given generation has moral responsibility for providing for their offspring

The Precautionary Principle


- Requires the exercise of caution when making decisions that may adversely affect nature, natural ecosystems, and global, biogeochemical cycles.
- “When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”
- Examples?

www.05.org
www.05.org
www.05.org

WE IN GOVERNMENT BELIEVE IN THE **PRECAUTIONARY PRINCIPLE**:
"NEVER STAND IN THE WAY OF A MEGA-CORPORATION THAT'S ABOUT TO MAKE A KILLING FROM POTENTIALLY HARMFUL PRODUCTS."



Outcomes of Decisions

<p>The Precautionary Principle helps us choose whether an action should, or should not be done, without knowing the risks with certainty.</p>	<p>The Columns A+B Represent a Human CHOICE</p> <p>Which column should we choose?</p> 		
	<p>A) Action Not Taken</p>	<p>B) Action Taken</p>	
	<p>These Two Rows are a <u>Prediction</u> or <u>Guess</u>.</p> <p>The certainty of risk is unknown and unknowable.</p> <p>We cannot choose the row.</p>	<p>Grave-Harm Caused=False</p>	<p>Benefits of Action not taken. Life continues</p>
	<p>Grave-Harm Caused=True</p>	<p>Benefits of Action not taken. Life Continues</p>	<p>Extreme Catastrophe Economic or Environmental Collapse Large Loss of Life <u>WORST CASE SCENARIO</u></p>

Precautionary Principle's Four Tenets

1. People have a duty to take anticipatory action to prevent harm.
2. The burden of the proof of harmlessness of a new technology, process, activity or chemical lies with the proponents, not the general public.
3. Before using a new technology, process, or chemical or starting a new activity, people have an obligation to examine a full range of alternatives including the alternative of not doing it.
4. Decisions applying the Precautionary Principle must be open, informed, and democratic and must include the affected parties.

The Reversibility Principle

- " Do not commit the irrevocable." Arthur C. Clarke
- Making decisions that are able to be undone by future generations.
- Examples: nuclear energy; GMOs
- Related to the Precautionary Principle but less stringent

The Polluter Pays Principle

- Addresses existing technologies
- The onus for mitigating damage is on those causing the impacts
- Compensation to those harmed
- Morphing into Extended Producer Responsibility (EPR)

Respect for Nature

- **Basis of an ethics of respect for nature:**
 1. **Humans are member of the community of life**
 2. **All species are interconnected in a web of life**
 3. **Each species is a teleological center of life**
 4. **Humans are not superior to any other species**
- **Same evolutionary process, governed by the same laws**
- **Humans are utterly dependent on other species for survival**
- **Other species are to be respected and humans should not compromise their survival**

Nature rules!



The Land Ethic

- Aldo Leopold (1949) suggests there should be an ethical relationship to the land and that this relationship should and must be based on love, respect, and admiration for the land.
- The land ethic makes sense because of the close relationship and interdependence of humans with land which provides food and amenity and contributes to air and water quality.
- Humans have tended to become disconnected from the land because of technological developments which give apparent but not actual independence from the land.
- Substitutes for natural material, for example polyester instead of cotton, furthers the notion that land is not essential for survival and that technology can provide suitable substitutes.



Aldo Leopold

“That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics.”

“The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.”-



Web of Life

Sustainable versus Once-Off Decision Making

- The issue is examining the temporal impact of decision making
- Example: the built environment
 - Buildings as waste or resource for future generations
 - Energy efficient versus less efficient structures
- Life cycle analysis
 - Life Cycle Costing
 - Life Cycle Assessment

Closure

- Sustainability is a complex issue addressing the sustainment of human quality of life
- The foundation of sustainability is ethics
- The ethical principles of sustainability provide a sound basis for decisionmaking but require courage in their application
- The principles should be comprehensive, covering human and non-human worlds
- Time horizons are crucial and must also be addressed