

Sustainability and Renewable Energies

ENVS 10
Lecture 17

Sustainability Definition

- Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability Definition (cont.)

- In an ecological context, sustainability is the ability of an ecosystem to maintain ecological processes, functions, biodiversity and productivity into the future.
- To be sustainable, regardless of context, the Earth's resources must be used at a rate at which they can be replenished.

Interdependent Goals of Sustainability

- All successful sustainable efforts must integrate **environmental health**, **economic profitability**, AND **social and economic equity**.

Human Impact

- There is now clear scientific evidence that humanity is living unsustainably, and that an effort is needed to keep human use of natural resources within sustainable limits.
- What are some ways in which we are living unsustainably?

Ways of thinking about Sustainability

- Individual: What can I do to reduce my ecological footprint (the impact that I make on the earth)?
- Corporate: How can businesses be “green”? How can the environment and businesses support each other?
- Government: How can the government help to guide us towards sustainability?

City of San Jose’s Green Vision

Green Vision Goals

Within 15 years, the City of San José in tandem with its residents and businesses will:

1. Create 25,000 Clean Tech jobs as the World Center of Clean Tech Innovation
2. Reduce per capita energy use by 50 percent
3. Receive 100 percent of our electrical power from clean renewable sources
4. Build or retrofit 50 million square feet of green buildings
5. Divert 100 percent of the waste from our landfill and convert waste to energy
6. Recycle or beneficially reuse 100 percent of our wastewater (100 million gallons per day)
7. Adopt a General Plan with measurable standards for sustainable development
8. Ensure that 100 percent of public fleet vehicles run on alternative fuels
9. Plant 100,000 new trees and replace 100 percent of our streetlights with smart, zero-emission lighting
10. Create 100 miles of interconnected trails

Sustainable Agriculture

- The ability of a farm to produce food indefinitely, without causing severe or irreversible damage to ecosystem health.
- Two key issues are:
 - Biophysical: the long-term effects of various practices on soil properties and processes essential for crop productivity,
 - Socio-economic: the long-term ability of farmers to obtain inputs and manage resources such as labor.

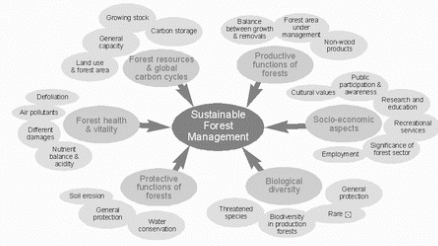
Sustainable Agriculture

- Elimination or reduction of synthetic pesticides/herbicides.
- Using polyculture and/or crop rotation as opposed to monoculture systems.
- Make use of local water and rain resources.
- Practice sustainable animal husbandry.
- Farm and sell locally (reduce petroleum use) - Community Supported Agriculture (CSA)



Sustainable Forest Management

Criteria and example indicators for sustainable forest management



Source: Ministerial Conference on the Protection of Forests in Europe

Sustainable Forest Management

- Not harvesting trees faster than the environment can grow them
- Balancing social/economic needs with ecological needs.
- Leaving ecologically sensitive areas intact.
- Leaving some forest areas untouched.
- Maintaining forest features that promote biological diversity and occupancy by rare species.
- Recycling paper and wood products.



http://www.german-timber.com/nation_forest_and_siberforest_management/

Sustainable Development

- Limit urban sprawl- functional downtown areas where driving is unnecessary.
- Keep natural areas accessible and healthy.
- Advance Planning- deciding ahead of time where to place types of developments/ businesses.

Green Building

- The practice of increasing the efficiency with which buildings use resources — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design, construction, operation, maintenance, and removal.



LEED Certification

- Leader in Energy and Environmental Design
- Green Building Rating System developed by the U.S. Green Building Council
- The rating system addresses six major areas:
 - Sustainable sites
 - Water efficiency
 - Energy and atmosphere
 - Materials and resources
 - Indoor environmental quality
 - Innovation and design process

Renewable Energy

- **Renewable energy** is energy generated from natural resources—such as sunlight, wind, rain, tides and geothermal heat—which are renewable (naturally replenished).

Renewable Energy

- Renewable energy technologies tap into natural cycles and systems, turning the ever-present energy around us into usable forms.
- The movement of wind and water, the heat and light of the sun, heat in the ground, the carbohydrates in plants—all are natural energy sources that can supply our needs in a sustainable way.
- Because they are homegrown, renewables can also increase our energy security and create local jobs.

Biomass Energy

- Oldest source of renewable energy known to humans (fire).
- Supplies almost 15 times as much energy in the US as wind and solar power combined.
- Includes living and recently dead biological material that can be used as fuel or for industrial production.
 - Trees, grasses, other crops (e.g., corn), oil plants (e.g., soybeans), wood waste in forests, sawdust and bark in sawmills, manure, human sewage, yard wastes, etc.
- Can be used to generate electricity, heat, or produce biofuel.

Hydroelectric Power

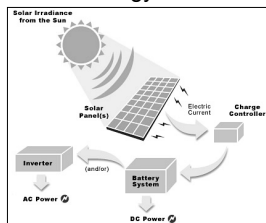
- Hydroelectricity is electricity generated by hydropower, i.e., the production of power through use of the gravitational force of falling or flowing water.
- Most widely used form of renewable energy.

Solar Power

- Harnessing energy from the sun to generate electricity.
- Can be used to light buildings, store energy to be used later for heat, concentrate energy to be used as electricity.



<http://www.theiberiac.com/2008/08/01/solar-energy-advances-regate-nuclear-argument/>



http://idmaker.umich.edu/line-student-tutorial/about_fm_

Wind Power

- The conversion of wind energy into a useful form, such as electricity, using wind turbines.



Geothermal Power

- Energy generated by heat stored in the earth or the collection of absorbed heat derived from underground, in the atmosphere and oceans.
- Usually in the form of hot water or steam.
- Can be used to produce electricity for power plants, heat and cool homes, etc.



Environmental Impacts of Renewable Energies

Biomass

- Air pollution (burning plant matter).
- Land use to grow biomass crops.

Environmental Impacts of Renewable Energies

Solar Power

- Manufacturing: fossil fuel energy and hazardous chemicals required to make solar cells used in panels.
- Installation: large-scale projects require a lot of land that is potentially used by wildlife.
- Disposal: getting rid of panels and chemicals used in manufacturing can pollute the environment.

Environmental Impacts of Renewable Energies

Wind Power

- Visibility
- Noise
- Impacts on wilderness areas and wildlife
- Land use conflicts - creating new roads to build plants, cutting forests, etc.

Environmental Impacts of Renewable Energies

Geothermal

- Air and water pollution - some systems tapping into geothermal heat create large amounts of solid wastes and noxious fumes.
- Safe disposal of hazardous waste.
- Many geothermal power plants require a large amount of water - potential conflict with other water users.
- Many hydrothermal reservoirs are in or near wilderness areas (e.g., Yellowstone NP, Cascade Mountains).

Environmental Benefits of Renewable Energies

- Avoid or reduce air emissions that pollute our atmosphere (e.g., nitrogen oxide, sulfur dioxide, carbon dioxide).
- Reduce water consumption, waste, noise, and adverse land-use impacts.
- Avoid depletion of natural resources for future generations.
- Reduce costs of emission-controls and pollutions as set by current and future environmental regulations.

Good Resource for Learning About Alternative Energy

- http://www.ucsusa.org/clean_energy/clean_energy_101/

How can YOU promote sustainability?

Table 20.1 **Some Important Ways You Can Promote Sustainability**

- Reduce consumption**
- Buy less.
 - Avoid excess packaging.
 - Avoid products made from nonrenewable resources.
 - Fix things rather than discarding them.
- Be more energy efficient**
- Bike, walk, or take public transportation instead of driving.
 - Share rides.
 - Purchase efficient appliances and vehicles.
- Promote recycling**
- Recycle at home and at work.
 - Purchase products made from recycled materials.
- Take political action**
- Vote for pro-environment policymakers.
 - Approve ecologically sound ballot measures.
 - Join an environmental advocacy group.
 - Write letters in support of environmental causes.
 - Run for political office yourself.
- Promote research and education**
- Talk about environmental issues with friends and family to raise their awareness.
 - Sponsor environmental initiatives on your campus or in your workplace.
 - Serve as a role model through your actions.
- Think long term**
- Realize that addressing environmental problems sometimes has short-term costs but long-term benefits.
 - Support policymakers and businesses that promote long-term environmental thinking.

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Table 20.1