8.4 Human Systems and Resource Use

Ecological Footprint
Carrying Capacity

• Is the maximum number of a species or load that can be sustainably supported by a given area
Why is it difficult to apply carrying capacity to local human populations?

• Usually you can estimate carrying capacity of a species by looking at the resources that are available

• For humans, this is very difficult!
Why is it difficult to apply carrying capacity to local human populations?

• 1. humans use a large range of resources
Why is it difficult to apply carrying capacity to local human populations?

• 2. when one resource is limited, humans substitute with a different resource

• Technological developments change the resources that are required or available
Why is it difficult to apply carrying capacity to local human populations?

• 3. humans vary in how many resources they use, depending on lifestyle!
Why is it difficult to apply carrying capacity to local human populations?

• 4. humans import resources from outside the immediate environment → allows pop. to grow beyond boundaries and increase LOCAL carrying capacity
Why is it difficult to apply carrying capacity to local human populations?

• Even though we can change our **LOCAL** carrying capacity by importing...

• It DOES NOT CHANGE THE **GLOBAL** carrying capacity!!
How is human carrying capacity determined?

- Rate of resource consumption
- Level of pollution created
- Extent of human interference on life-support systems (e.g. ozone layer, forests, oceans and MANY MORE!)
Ways to change human carrying capacity

• Compare and contrast how ecocentrists and technocentrists would change human carrying capacity?
Ways to change human carrying capacity

• Econcentrists
• Reduce, reuse, recycle can help!
Ways to change human carrying capacity

• Technocentrists
• What’s the problem we will always have enough we can expand carrying capacity by growing more food with technological advancements.
Ecological Footprints
1960-2005
- Ecological Footprint

2005-2050, Scenarios
- Moderate business as usual
- Rapid reduction

y-axis: number of planet earths, x-axis: years
What is sustainability and ecological overshoot? Then answer: If you had the power, what actions would you force governments to take now to safeguard the environment but also protect humans from suffering? Give your reasons.
• **Environmental sustainability** - is meeting the needs of the present without compromising the ability of future generations to meet their needs

• If a society supports itself by depleting essential forms of natural capital this is unsustainable

• Human wealth is dependent on the goods and services provided by natural capital

• The rate at which it is used should not exceed the rate at which it is renewed (or it will be depleted)
Ecological overshoot

• There is a finite amount of materials on Earth and we are using much of it unsustainably

• UN data – humanity has overshot its sustainability level of resource exploitation

• In 1961 we used 49% of Earth’s resources

• 2001 it was 121% we have overshot the sustainable level

• 2014 about 150%

• Why does this continue?

• Some see change as too difficult
We are Here

Carrying Capacity

Overshoot

Degraded Carrying Capacity

Consumption

Time
You must have all three working together to have sustainability.
Ecological Overshoot Video 2min 25sec

Ecological Footprints

Notes:
(1) "Energy land" is defined as the theoretical amount of land required to be planted in exotic forests to absorb our carbon dioxide emissions.
(2) "Fishing land" is the area required to support the fishing industry and the production of seafood.

Source: Ministry for the Environment.
Ecological footprints

• EF’s - models used to estimated the demands that human populations place on the environment.

• A measure of:
  • Area required to provide all the resources needed
  • Area required to assimilate all wastes

• When the EF is greater than the area available to a population, this indicates UNSUSTAINABILITY
Ecological footprints

- EF’s vary from country to country and person to person
- Based on factors such as:
  - Lifestyle choices (EVS)
  - Food production systems
  - Land use
  - Industry
Components of an EF

- Carbon
- Grazing
- Forest
- Fishing
- Cropland
- Built-up land

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Source: Ministry for the Environment.
**Cropland** – area used to produce food and fiber for human consumption, feed for livestock, oil crops and rubber
Forest – amount of lumber, pulp, timber products and fuel wood consumed each year
Grazing land – area used to raise livestock for meat, dairy, hide and wool products
Fishing grounds – primary production required to support fish and seafood caught
**Built-up land** – area of land covered by human infrastructure: transportation, housing, industrial structures, reservoirs for hydropower
Carbon footprint – amount of forest land required to absorb CO$_2$ emissions from burning fossil fuels (not including the CO$_2$ that is absorbed by the ocean)
What can it do?

• It can provide a quantitative estimate of human carrying capacity, which is the inverse of a footprint.
• Ecological footprint refers to the area required to sustainably support a given population.
• Carrying capacity refers to the population that a given area can support.
Countries and individuals

• Individual ecological footprints can estimate the amount of land needed to support the lifestyle of an individual.
• A country’s footprint is calculated by taking the average footprint (per capita footprint) for individuals in a population and multiplying it by the population.
• You usually see a country’s per capita footprint reported.
Why do some countries have such large footprints?

• Great use of fossil fuels.
• Increased technology
• Lots of imported goods (increased need for transportation)
• Large per capita production of carbon waste.
• Large per capita consumption of food.
• Meat rich diet.
How do some countries have such small footprints?

• Reduced, reuse, and recycling of resources
• Improved efficiency and technology
  – Hybrid cars
  – GM crops
• Reduced pollution
• Exporting waste products
• Importing of resources.
• Reduced population