Human Impacts
Chapter 38 (part 2)

+ Unnecessary Consumption
  *the case of the plastic bottle*

- Where do they come from?
- How are they made?

Oil Platform

What is oil?

Sequestered under rock at the bottom of the ocean...

Oil Tanker Transportation

Typically carries 10,000 – 550,000 DWT (deadweight tons)

- Burns Bunker (Heavy fuel oil)
  - Inefficiently burned (1000X less)
  - 0.008 mi/gal, or 42 ft/gal, or 125 gal/mi
  - HUGE impact on air quality (SO\(_x\), NO\(_x\))
Fractional Distillation Process

All petroleum products obtained this way

"Nurdles"

Molding The Plastic

Sterilizing The Plastic
**BOTTLING**
- Is the water in the bottles different from your sink?

**FINALLY!!!**
- Let's Drink!
- two hours later...

**Let's compare...**

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<thead>
<tr>
<th>Time and Energy</th>
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<td>Hundreds of Millions of years to make the oil</td>
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<td>Add chemicals to make nurdles</td>
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**But There's More To The Story...**
- What happens next in the life of a plastic bottle?
- Approximately 5-10% actually recycled!
- Most bottle tops NOT recyclable
- Recycled bottles DON'T become new bottles
- Melting degrades quality, so re-molded into lesser products
- Want more water bottles? You need more oil...

**Natural “Decomposition”**
- 3 weeks
- 2 months
- 1 year
- 80 years
- 500-1000 years
- 1,000,000+ years

**WHAT DO WE DO WITH ALL THIS PLASTIC??**
Plastic Pollution

North Pacific “Garbage Patch”

Santa Monica Bay fundraiser, 2007
Chemical Adsorption and Release

Chemical adsorption and release mimics estrogen.

Bisphenol-A (aka BPA)

Mimics estrogen

- PSDEs
- Nonylphenols

Chemicals in Plastics

- Bisphenol A
- Phthalates
- PCBs
- DDT

US “safe” limit set at 50 ppb, but...

- 93% of Americans sequester 2.7 ppb of BPA (Sexton, et al., 2004, American Scientist, v92: 38-45.)

- In animal testing experiments
  - at 30 ppb some animals develop ADD-like symptoms
  - DNA damage at 20 ppb
  - Insulin resistance at 10 ppb
  - at 2.4 ppb, sexual developmental problems
  - Infants can get up to 13 ppb/day from polycarbonate bottles

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<td>Thousands of years to leave the environment... for each plastic bottle!</td>
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<td>Long-term damage to people and the environment...</td>
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FYI – Cigarette butts ARE trash!

- Cigarette filters made from cellulose acetate (a type of plastic)
- Designed to remove and concentrate toxins. 60 known carcinogens (e.g. arsenic, formaldehyde, chromium, lead)
- Do-it-yourself goldfish experiment

What can you do to help???

Educate others:
- Reduce,
- Reuse,
- Recycle

In that order!!!

How can you REDUCE?

- Don’t use so much stuff!
- Pay attention to amount of packaging
- Get off junk mailing lists

- Use less energy
- Use less water
- Get others to do the same!
How can you RE-USE?
- Re-usable water bottles / coffee travel mugs
- Get re-usable containers
- Cut back on disposable items (use regular plates and silverware)
- Get re-usable containers
- Gray water recovery systems

RE-FILL your bottle!
- Filtered Tap Water!

Foreign Oil Handcuffs
- We SHOULD:
  - Have a separate Gov agency to steer us away from foreign oil.
  - Think innovatively – de-emphasize oil.
- Wait a minute….
- We DO have one!
- Why were they established?

How far have we come?
- 1970 – US imports = 25%.
- Today – US imports >60% (some estimates >75%)
- Top import sources:
  - BIG 5: Canada (16%), Mexico (15%), Saudi Arabia (14%), Venezuela (12%), and Nigeria (11%)
  - NEXT 5: Iraq, Angola, Ecuador, Algeria, United Kingdom = 68% = 17%
- We only have 3% of the world’s oil reserves. Solution?

Fossil Fuels, Climate Change
- Carbon dioxide is a by-product of burning fossil fuel.
- CO$_2$ is a greenhouse gas that is likely causing global warming.
- Consequences:
  - Temperature rise in general.
  - Polar ice caps will melt.
  - Sea levels to rise.
  - Erratic weather.
  - Coastal flooding and inland droughts.
  - Etc.

Four main carbon sinks on Earth with routes of exchange between each
Carbon Sinks and Releases
- Sinks (stores carbon):
  - Land (photosynthesis)
  - Ocean: Deep ocean circulation
  - Plankton: Photosynthesis & shell formation
- Releases:
  - Plants: Respiration (opposite of Photosynthesis)
  - Decaying organic matter
  - Volcanic Eruptions
  - Biomass combustion (fossil fuels, forests, etc)
  - Cement factories (lime production)

The “Irreversible experiment”
The increase of atm. \( \text{CO}_2 \) from this cause is small at present, but may become significant during future decades if industrial fuel combustion continues to rise exponentially.

Long-term Scale of \( \text{CO}_2 \)
Atmospheric \( \text{CO}_2 \) since 1000 AD

The Keeling Curve
Charles Keeling
Was 280 ppm in 1850

Dr. Pieter Tans, NOAA/ESRL
www.esrl.noaa.gov/gmd/ccgg/trends/

We’re releasing fossil carbon faster than Earth sequesters it

395 ppm by May 2012??
Earth Cycles

Milankovich Cycling

- #1 Eccentricity (100,000 years)
- #2 Axial tilt (41,000 years)
- #3 Precession (26,000 years)

Long-term inorganic Cycling

- 7 ice ages (consistent with Milankovich)
- 7 warm periods (consistent with Milankovich)

Global Climate Change

- Scientific consensus – the Earth is warming, and humans are to blame
- Data controversy?
- Political controversy?
- Who should I "believe"?
- What should I "trust"?

"What gets us into trouble is not what we don’t know. It’s what we know for sure that just ain’t so.”

- Mark Twain

John Coleman
Weatherman, KUSI News, San Diego

- “Skeptic”

Fact checking...

No longer on KUSI website

Were you convinced by this video?

Problems with his argument?
Skeptics?

- Very few in the scientific community.
- Disagreements among scientists usually center around data quality and methodology.
- Anatomy of a skeptic… Tim Ball
  - Actually, Professor Emeritus of Geography
    - Was a Professor for 8 years (1988–1996), NOT 23 years…
  - Director of “Friends for Science” – funded by the Canadian Oil Industry
  - Co-chair of “Natural Resources Stewardship Project”, supported by High Park Group, a lobby group (backed by Canadian Electricity Association and the Canadian Gas Association)

And Mr. Coleman???

- What is a “meteorologist?”
- Scientist?
- Bachelors degree in Journalism
- No formal science training at all (never took an advanced science class in college)
- Peer-reviewed publications = 0

Are humans changing Earth’s climate through CO₂ pollution?

- Like, no way. Rex Tillerson & Senator Jim Inhofe say it is fake.
- Evidence from 1000’s of scientific studies show climate change is occurring
- Our scientists tell us it’s natural
- It’s a hoax!

Recent climate events:

- Avg surface temp increased – 0.74°C over past 100 yrs (1906 - 2005)
- 1998-2010 were 15 of 16 hottest years on record
- 2009 6th hottest
- 2008 & 2010 TIED for the hottest year on record

It is difficult to get a man to understand something, when his salary depends upon his not understanding it!

– Upton Sinclair
Intergovernmental Panel on Climate Change (IPCC)
- Established in 1988
- Over 480 lead authors
  - Over 800 contributing authors
- Over 3,500 expert reviewers
- Over 130 countries represented
- A CONSERVATIVE document
  - Reviewed by politicians, and yet still conclusively shows man-made problem.

"Carbon dioxide is portrayed as harmful. But there isn’t even one study that can be produced that shows that carbon dioxide is a harmful gas." - Bachman

http://www.youtube.com/watch?v=IAaDVOd2sRQ

What about “clean coal”?

Understanding Carbon Signatures
- Is the CO₂ increase from a natural warming event? (e.g. is the story being told backwards – is it fluxing from the ocean?)
- Recall: Carbon isotopes – ¹²C, ¹³C, and ¹⁴C (6 protons, 8 neutrons)
- Increased atmospheric CO₂ has a ¹⁴C/¹²C ratio identifying the source as fossil fuel combustion
- Ratio is NOT consistent with that in seawater or rocks.

Alternative Energy
- Perpetual Sources:
  - Solar energy
  - Wind power
  - Tides (won’t discuss here)
- Renewable Sources:
  - Hydropower (hydroelectric power)
  - Geothermal energy (heat from beneath the Earth’s surface)
**Solar Power**
- Most Americans are familiar with this.
- Sun energy is free
- Solar panels can be pricy… but dropping in price

**Wind Power**
- Denmark: 20% wind powered
- Forced into it in 1973

**United States:**
- 6% wind powered by 2020
- 20% wind powered by 2030

**Hydroelectric Power**
- 20% worldwide.
- Environmental effects

- Waterfall blockage

**Geothermal Power**
- Uses heat generated from deep in the Earth
- Santa Rosa Geysers Recharge Project

**Working Toward Sustainability**
- **Sustainable society:** use resources responsibly and protect biodiversity.
- Currently, societies are not sustainable.
  - Land used for humans, for natural ecosystems.
  - Agriculture relies on non-renewables.
  - Too much agriculture goes to livestock.
  - Reliance on fossil fuels and minerals (non-renewables).
Working Toward Sustainability

- Sustainable society characteristics:
  - Reduced use of “stuff” per capita
  - Emphasis on Perpetual and Renewable energy sources
  - Heat and waste materials minimized, and efficiently re-used
  - Maximal recycling of all resources

What can you do to help???

1. Be an environmental steward – live sustainably
2. Trust science (evidence!)
3. Consume less energy and stuff in general
4. Reduce (or eliminate!) your use of “disposable” plastics
5. Reduce your exposure to hazardous materials
6. Be aware and vote

Ignorant Politicians – for example...
- Representative Hank Johnson (D-Georgia) – 3/25/2010

Love Nature… But don’t “Love Nature”

“In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught.”

Rabbi Ishban
(Senecatess) conservationist

The end… You made it!