**Enviro Issues Exam Review Fall 2017**

* *Please share any lecture notes, module notes, and key concepts* 
  + ***There is a section for key concepts, please everyone fill out one as you come on because it makes it easier to finish all of it!***
* *If anyone has any questions about any of the material or any corrections to any of the material posted, please comment on the side instead of putting it within the doc. This makes it easier for everyone to follow.*
* *Please follow and post in the sections provided below so it’s easier to follow also*
* *Thank you all and best of luck on the exam <3*
* **Bernier specified which key concept (from each unit) he’ll be putting on the exam. He posted it on Avenue. → Podcasts**

**Notes for key concepts from modules are at the bottom!**

**Key Concepts to Know: PLEASE FILL IN AS YOU VIEW THE REVIEW**

Lecture 2

* **Impact of population growth**
  + Population of the world trend from 1950s to projection in middle of century
  + **9.5 billion** = uppermost limit projection for the middle of the century
    - Right now: close to 7 billion
    - End of century, possibly at 10 billion people
  + **National population growth has increasing number in less developed countries which leads to more emerging needs (i.e., India and Pakistan, previously China)** 
    - **More developed countries have a declining national population growth**
  + **India is predicted to overtake China as most populous country**
* **Impact of consumption** 
  + Consuming more and more energy
  + Graph shows how much electricity we are using per person in each country
    - Ethiopia: has other issues like wars to deal with that is taking up most of their resources thus making both their HDI and their electricity use lower
    - Canada: ranked highest in HDI (human development index) and tends to use the most energy
    - Spain and other European countries with high HDI prove that you can use less energy
  + **Wealthiest countries consume 25 times more energy/capita than poorer countries**
* **Eco footprint: what it is, trend**
  + It measures human use of the environment in hectares per person
  + Canada is the 3rd highest
* **Biocapacity and relation to eco footprint**

Amount of area available to meet humanity’s needs

* **Canada’s footprint and impact**
  + Canada is the highest producer per capita of waste products
* **Jurisdiction over the environment in Canada, and trends**
* Federal municipal and provincial roles

Lecture 3

* **Biodiversity and energy flow in ecosystems**
* **Biodiversity and endemic species in canada** 
  + What are Endemic Species?
  + Species that are unique to a particular geographic location and not found anywhere else on Earth. For instance, if species XYZ is endemic to Canada, that means XYZ can only be found in Canada and nowhere else… Not even China
    - I.e. Vancouver Island Marmot
  + Species that are found nowhere else on the Earth
    - Canada: 1-5% (such a low number because it was once completely covered in thick layers of ice sheets; prevented animals to live here. eg. Vancouver Island Marmot)
* **Invasive species in canada**
  + Invasive species are found outside their normal habitat
* They cause great damage to the new environment they settle
  + - Able to outcompete the native species and drive them into extinction
      * I.e. Purple Loosestrife
    - Mess up the ecological niche of the ecosystem
      * Asian Horned Beetle
* In Canada, 500 species of alien plants are now weeds
* Substantial increase of invasive species in Canada started in 1800s
* 12% of the species in Canada today are not native to Canada
* Examples:
* Eurasian water milfoil (appeared in the 1970s in British Columbia)
* Asia grass carp; destroy the biodiversity by eating all the water plants within the great lakes (several teams are fighting against these fish in the great lakes and St. Lawrence river)
* Zebra Mussels started to appear in the late 1980s in the great lakes. Can clog pipes and cause major problems. Best way to get rid of them is through chemicals. Came to Canada through ships when they take in water to help better balance the ship during their travels. $**200-500 million of damage to public utilities per year.** The muscles have spread throughout most of the bodies of water in North America in a matter of a couple years
  + - * Originate from the Caspian Sea, and snuck away on the Ship’s ballast water
* **Canada’s record; trends and efforts**
  + While Canada has policies to protect its biodiversity, it remains in practice poorly tracked monitored
  + Invasive species constitute a major challenge in Canada – particularly for aquatic ecosystems
  + Canada has a poor record in the implementation of strategies against invasive species

Lecture 4

* **Eutrophication: what is it and its cause**s
  + **Eutrophication:** excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen (lack of oxygen = hypoxia)
    - Caused by frequent runoff from land; species that live at the bottom of the ocean that need oxygen will die due to the process of eutrophication (fish will begin to die)
    - Two nutrients involved are Phosphorus and Nitrogen
      * These come from nearby farms
        + I.e. Ohio dumps shit in Lake Erie and now Lake Erie has an algae problem.
    - Eutrophication causes algal blooms because Algae love phosphorus
* **The impacts of human activity on the flow of nutrients**
  + Humans use a lot of chemicals and fertilizers in their everyday lives, this can run off into major bodies of water through natural processes such as surface runoff. Causes a great amount of marine problems
* **Aquatic dead zones: what are they, examples**
  + Excessive nutrient pollution from human activities coupled with other factors that deplete the oxygen required to support most of the marine life in bottom and near-bottom water
    - Ex. Mexican dead zone: the mixing of agriculture and urban runoff in the Mississippi River that goes into the Gulf of Mexico
    - Ex. Lake Erie: major amount of pollution runs off into the lake from Detroit and surrounding cities
  + Oxygen depletion is known as hypoxia
  + Hypoxic environment = Area that has little to no oxygen content
* **Eutrophication in Lake Erie: history, sources, algae involved, issues**
  + From satellite images of the earth taken in 2011, you can see major algal blooms in the west end of the lake (near Detroit)
  + Major source of phosphorus in the lake is a nonpoint source
    - Nonpoint includes anything such as sewage treatment, oil, toxic chemicals, sediment from construction sites, fertilizers, and other agricultural chemicals etc…
    - Algae found in 30% of Ohio farmland food due to the use of lakewater to water crops (algae in the lake comes from areas where there is a higher concentration of agriculture)

Lecture 5

* **Characteristics of the trends in environmental policy since the 1990’s**
* Preoccupation with debt reduction → More focused on the economy than ecology
* Download of responsibilities to other levels
  + Federal dumps responsibility to provincial who dumps responsibility on to municipal
* Little interest in consultative processes
* Backing away from commitments to environmental issues
  + Can be attributed to short presidential terms
    - 4 years/term
* **How should a solution to environmental issues be articulated** 
  + Realistic, credible, and attractive future for a region or group
  + During development around a problem, questions to answer:
* What is likely to happen?
* What ought to happen?
* What can happen?
* **Ethics: ecocentric vs Technocentric**
  + Set of moral principles or values that guides the actions or decisions of an individual or groups
  + **Ecocentric perspective**: places intrinsic value on all living / non-living things and their natural environments
  + **Technocentric perspective**: is a value system that is centred on technology and its ability to control and protect the environment.
    - Believes that technology will save the world and reverse enviro. Degradation
  + NOTE: The difference between biocentric and ecocentric is that biocentric ONLY focuses on all living things, while ecocentric focuses on biotic and abiotic things
* **Environmental justice and the basel convention** 
  + According to the United States E.P.A: fair treatment and meaningful involvement of all people
  + When addressing negative environmental problems, this means no group of people should bear a greater share of the consequences
    - For example: Some companies tried to dump chemicals in poor communities
  + Regardless of race, colour, national origin, or income
  + The Basel Convention extends environmental justice to prevent the dumping of hazardous materials (i.e. e-waste) into other (poorer) countries
    - An international treaty to reduce movements of hazardous waste between nations
    - Signed in 1989, in Switzerland, 53 countries have ratified it thus far
    - Extends the principle of environmental justice to international trade of hazardous materials
* **Issues with E-waste**
  + Many political issues surrounding e-waste around the world
  + Many developed countries are shipping their electronic waste (old computer parts, cell phones etc) to less developed countries for a price
  + When arrived to the final destination, workers take apart the e-waste and try to recycle the valuable metals using very old methods
    - Workers are subject to harsh conditions, having to breathe in toxic chemicals

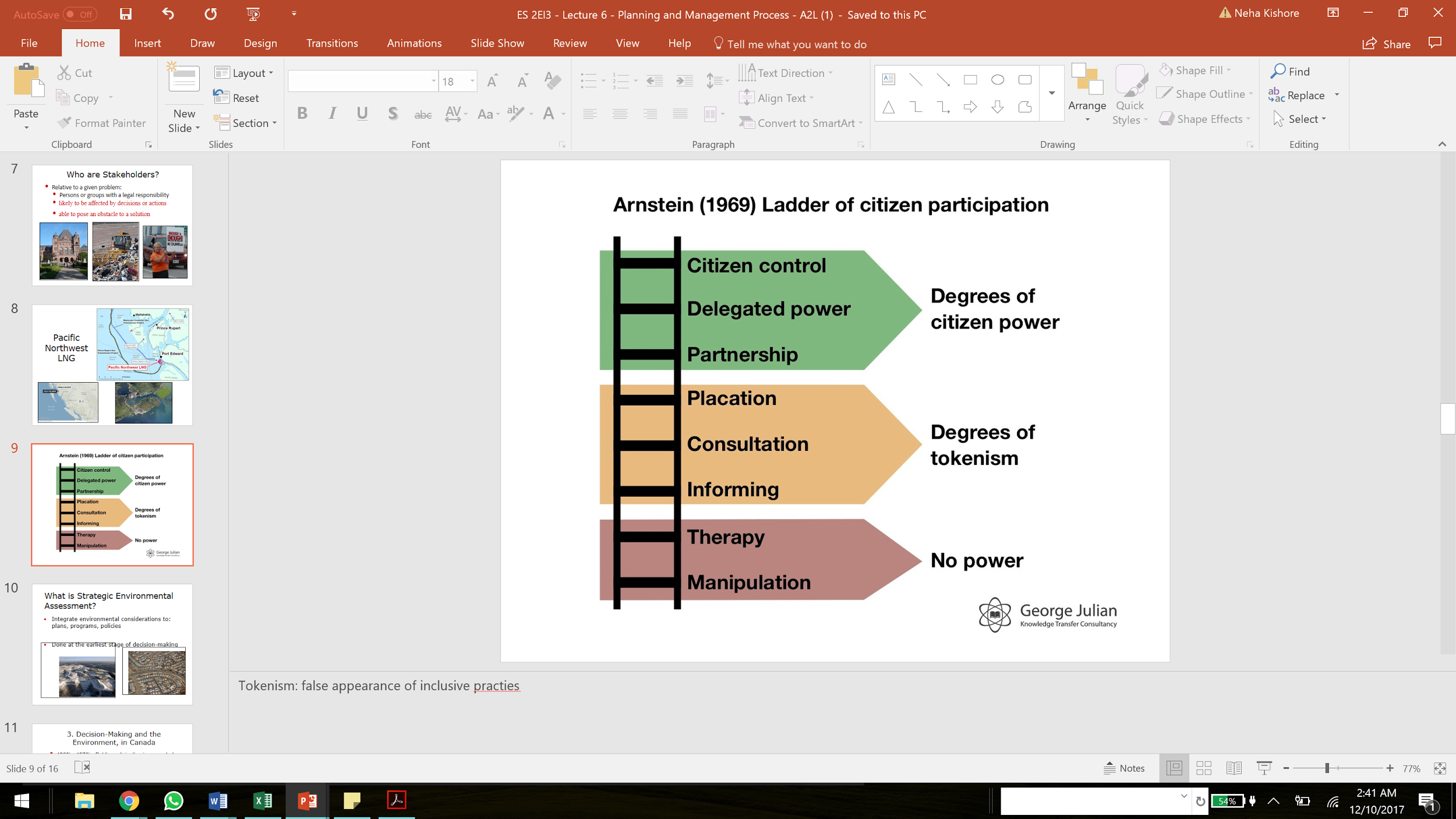
Lecture 6

* **Motivations for disputes over the environment** 
  + Positive: if it helps clarify possible confusion
  + Negative: if it reinforces biases
* **Coordination and collaboration** 
  + The Boundary Waters Treaty, 1909: for resolution of disputes over shared waters through the IJC
    - SO2 emissions in BC, protect air, and water within the area (1928)
    - Flooding, (1944)
    - Invasive species, protect lakes, rivers, and streams (1975)
    - Water trading, policies in the great lakes to protect them (1999)
* **Environmental impact assessment**
  + Identification and prediction of the impacts from development proposals
  + Impacts on the environment are common to all initiatives
  + Intended or unintended environmental impacts
  + Positive or negative environmental impacts
    - Social and human well-being
    - Physical and biological
  + Even something as trivial as releasing wild turkeys must be screened using EIA
* **Stakeholders, and the Rungs of citizen participation**
  + Who are the stakeholders?

Relative to a given problem:

* + - * Persons or groups with a legal responsibility
      * Likely to be affected by decisions or actions
      * Able to pose an obstacle to a solution
      * Have information/knowledge pertaining to the problem

Ladder of Citizens participation:

***<--- can someone explain this (read below)***

At bottom of ladder citizens are “cured” by powerholders aka therapy… then up the ladder a little the citizens are given false inclusion ex. their advice is received but not acted on… at the top they have power, and given management responsibility

* There are 3 degrees to the ladder of citizen participation
* 1. No Power
  + Citizens are “cured” by power holders
    - Cured = Therapy or Manipulation
* 2. Tokenism
  + Citizens are given a false sense of inclusion
    - They’re advice and proposals are well received but ignored
* 3. Citizen Power
  + Citizens are given power, control, and responsibility
    - They’re advice is taken into account and influences the final decision

* **Strategic Environmental Assessment**
* Integrate environmental considerations to: **plans, programs and policies** 
  + Biophysical, social and political aspect taken into consideration define one of the best policies
  + SHOULD BE DONE before any decision should be made
  + No political parties should have a say before the SEA is done
* Some projects that should be considered under SEA are Examples:
  + **Sectoral programs:** mining resources, regeneration,
  + **Urban planning**: suburban development, revitalizing the rural periphery to add more farming
  + **Environmental quality**:
    - impact of these issues
    - What are the alternatives?
    - Integration of other possible ideas? Looking to not just consider one aspect. Consider also social dimensions. For present and or years to come.
* Implementation has to be done by political parties throughout the years
  + Before anything comes at any level, this is the kind of process that should take place
* **Historic Trends in Environmental decision-making, in Canada**
  + 1960s - 1970s: public participation incorporated into environmental management initiatives
  + Decision-making by public = anarchy
* James Bay, Hydropower scheme
* 1980s public dissatisfaction with the process
* ex. Great Lakes Water Quality Agreement of 1987
* Projects no longer covered by Federal EIAs (2013)
* Groundwater extraction facilities;
* Heavy oil or oil sands processing facilities;
* Pipelines and electric transmission lines not regulated by the National Energy Board;
* Potash mines and other industrial mineral mines (salt, graphite, gypsum, magnesite, limestone, clay, asbestos);
* Pulp and paper mills, steel mills, metal smelters, leather tanneries, textile mills and facilities for the manufacture of chemicals, pharmaceuticals, pressure-treated wood, particle-board and plywood, chemical explosives, lead-acid batteries and respirable natural mineral fibres

Lecture 7

* **Evidence of climate change and scientific explanations for it** 
  + Since the 19th century, the average global temperature has increased by 0.85°c +0.2°c
  + We are currently experiencing the warmest years since the 1850’s
  + Scientific explanation: there is a strong consensus that increase in GHG is from human activity
* **Forecast of impacts on natural systems and human society**
  + Melting of ice in cryosphere, sea levels rising
  + Food:
  + - Crop yields will fail
  + - Rising yields predicted in some higher latitudes however falling yields in developinh regions
  + water:
  + - glaciers melting
  + - decreasing water in South Africa and Mediterranean
  + -sea level rise can threaten cities
  + Ecosystems:
  + - damage to coral reefs
  + - species face extinctions
  + Extreme weather events:
  + - storms, forest fires, droughts, flooding, heat waves
  + Irreversible large scale changes
  + Human:All aspects will be affected:
  + - human health
  + - communities and infrastructures
  + - resource industries
  + - service industries
  + -security and trade
* **Impacts on PEI what’s PEI??help pls PRINCE EDWARD ISLAND - rating loss thx**
* - Globally sea level rises 0.1-0.2m per century during the past 100-200 years
* - North shore of PEI is the most sensitive
* - Increases storminess
* - Increased erosion b/c rock is susceptible to erosion
* - Municipal infrastructure would be affected ($ 200 million Projected)
* **The Kyoto protocol, its stipulations, and its fate** 
  + Was the first major effort to address climate change
  + It eventually collapsed, and when it did, Canada had exceeded its target by over 25% instead of decreasing their emissions
    - Decided to focus on economy instead
  + China & India were not apart of it
    - Bush was all like yo wtf that aint fair
  + Around 55 countries were apart of it
* **Canada’s record on Climate change**

Lecture 8

* **Climate and the ocean**

-Balance between the amount of CO2 in the atmosphere and bicarbonate in the ocean  
 -1/3 of annual human CO2 emissions end up in the ocean

- Leads to ocean acidification  
-50% of human emissions of CO2 since 1750

-increase in acidity of water makes it hard for sea creatures to make shells

* **Ocean management challenges**

· Continental Shelves: 18% of the ocean provides 90% of global fisheries

· Some of the world’s populous cities ex. Shanghai are on a coastline

· By 2100: 75% of world population will be living in coastal cities

· 11% of land

· Virtually no region of the ocean is going to be untouched

· Fisheries provide: 20% of global protein supply

· 2.6 billion – closer to 3 b now, people are dependent on fish as protein supply~ Oceania, Asia

· Landings from area covering less 7.5% of ocean

* Global fisheries will collapse by 2055
* Over 50% of global fishers are over-fished / exploited
* **Collapse of the cod fisheries**

· Grand Banks

· Cod being caught by family owned boats

· Catch in the late 1950’s: 150,000 tonnes

· 1974: 35,000 tonnes

· 1977; Canada declared a 200 – nautical mile: exclusive fishing zone off its coast ~ resolved the problem only a bit

· Collapse of Atlantic cod stocks off the east coast of Newfoundland in 1992 drastically dropped

· DFO says there is still “a lot of fish”

· 1993: cod fish banning … already too late

· Sharp reduction in quotas for other species to avoid this happening to other species

* **Pollution**

· Main sources of marine toxins in Canada:

o Air borne pollutants

o Agricultural runoff

o Sewage

o Waste from refineries

· Bioaccumulation and biomagnification

· PBDE’s: Polybrominated diphenyl ethers

* This is a flame retardant material
  + This means that it delays or inhibits the spread of fires

-killer whale most chemically affected

· Long range transport of toxicants an issue

· Levels of DDE and PCB’s in double crested cormoran eggs

· Ex. Aboriginals in arctic are exposed to this: those 2 chemicals found in breast milk

* **Aquaculture**

· 50% of global fishery

· Fastest growing food production sector in the world

· BC: 4th largest producer worldwide of farmed salmon

* 11x more toxins found in wild fish than Aquaculture
* Aquaculture isn’t the greatest because diseases spread very fast inside the tanks
  + Chemicals are used to control diseases
* Aquacultures are very inefficient because lots of energy is lost
  + It takes 3 - 4 kg of small fish to produce 1kg of Salmon
* Salmon loses its pink color, so its fed some shit like astaxanthin and canthaxanthin to get that pinky color back. However these two chemicals can damage the retina (your eyes)

Lecture 9

* **How is water used in Canada; comparison to other countries** 
  + Canada has low population but 20 percent of fresh water reserves, bordering the Great Lakes
    - 20% of the world’s freshwater is in Canada (the gr8 lakes)
  + Out of the worlds population Canada has 0.5%
  + Contribution to economy: upto 23 billion dollars
  + 30 percent used for toilets, and 35% for showers/baths
  + According to Canadian Water Attitudes Study, 2011: 55% of people think water is Canada’s most important natural resource
  + No idea of how much household pays for water use: 61%
  + Toilets use 30% of water used in a household and 35% to showers, baths
* **Issues with point source pollution and emerging contaminants** 
  + Can identify where pollutants are coming from
  + Secondary treatment is most expensive and improves water quality (the best)
  + 2009: 12.9% municipalities no connected to sewer system, in total this is 4 million ppl
  + 57% of small cities have no waste water treatment
  + Need to upgrade: 5.4 billion dollars annually
  + Walkerton, Ontario had its water contaminated by E.coli
* **Access to safe and sufficient water issues** 
  + 40% of population have no access to sanitation
  + No.of people who get by 50l/person/day: ⅔ world population
  + 200-300l/person/day: 4% of world population
  + In 2000, Walkerton, Ontario had its water polluted by E.coli
    - 7 people died, and hundreds were sick
    - The guy in charge of maintaining water was/is a dumbass and didn’t pay attention to the wells and water systems
* **Access to water and first nations** 
  + Third world conditions
  + 2014: 460000 lived in 600 reserves across Canada.
  + In 2001: water systems on reserves with significant to quality and safety of drinking water: 75%
  + Boil water advisories in Canada, 133 advisories for 93 First Nations
* **Exposure to floods and reduction of damage**
* **-** Structural approaches: behaviour of system is modified
  + o May lead to false sense of security
* - Non structural approaches: modify behaviour of people
  + o Zoning restrictions
* **Water ethics and canada’s role**
  + Water resource may become as strategic as oil resource during current century.
  + Canada is opposed to having water as a human right. Belief that canada's sovereignty over its water may be challenged. Canada opposed this 2002, 2006 and 2010

Lecture 10

* **Geographical distribution of the major types of food production**
* **Traditional agriculture and industrialized agriculture**
* Traditional agriculture : Extensive land Requirements
* - Little labour and capital
* - No energy demand
* Industrial Agriculture
* - Moderate amount of land
* - Little labour
* - Capital investment and extensive use of fossil fuels
* - 8% of population in developed countries is involved in Agriculture
* - 60%, and sometimes higher, of population in developing countries is involved in agriculture
* **Trends in agriculture, over the past 50 years:** development of monoculture (grow 1 crop to maximize yields) ex. rice patties in South Asia
* Increased use of land, pesticides and fertilizers
* **The green revolution and its impacts**

· Production of more food by:

o Increasing number of arable hectares

o Increasing yields, increasing since 1950

* The green revolution has dramatically increased the harvesting of rice and wheat
  + 48% of our diet comes from grains
  + Rice does not grow past 40 degrees Celsius
  + NERICA rice is the future. It’s resistant to pests, and has more protein
* **Trends in food availability, energy consumption, and the human diet**
* North America consumes 3400 calories per day

To supply a meatless diet, population growth requires: doubling of the 1990 grain production

* - Global Population is expected to be 8 billion by 2025.
  + - And 10 billion by 2100

Lecture 11

* **Worldwide trends in food production** 
  + **·**  Between 1700 and 1950: cropland increased from 250 million to 1.2 billion ha
  + · Limited well-suited land
  + · Small opportunity for expansion
  + Intensification of production: key strategy in most part of the world
  + 1967: 648Mha, 2002: 671Mha
  + · Production of cereals does not: match worldwide demand
  + o 2011: 2.3 billion tonnes
  + o Lowest stocks in 30 years
  + **· 48% of diet from grains**
  + **Rice does not grow past 40 degrees Celsius**
  + **NERICA rice is resistant to pests and has more protein**
* **Impacts of global warming; consequences of alternative fuel source**
* · Over 30 years, yields likely to decline by: 10% for every 1˚C increase
* · 40% reduction in yield
* Insects proliferate at high temperatures
  + Damage from pests expected to hit in the billions, like $5 billion by 2030, and 43 billion by 2050
* · Rice: no fertility at 40˚C (does not grow)
* · Oil: 95% of transport
* **Problems associated to the Green Revolution**
* · Global production of wheat and rice dramatically increased
* o Selective breeding
* o Intensive irrigation
* o Fertilizer use
* Mexico: conversion of agriculture to biofuel led to civil unrest cuz ppl. couldnt afford the corn
* · 1st Green Revolution: developed countries, 1950
* · 2nd Green Revolution: new strains and farming practices developing countries, 1967
* o NERICA rice
  + 50% more yield, less fertilizers and and is resistant to conditions.
* Depletion of Nutrients: a Problem
* · Use of fertilizers has reached its limits
* · More fertilizers doesn’t necessarily mean more yields
  + Soil quality has severely degraded and to cope, farmers dump more fertilizers on the soils
    - Leads to more agricultural run-off

* **Rise in the use of GMOs**
  + Miracle seed=new strains
  + Use GMOs because yields achieved through conventional methods will not increase sig in future
* **Agriculture as an ecological process; use of biocides**
  + Subsistence farming: meet the needs of one household, it is less energy intensive
  + Per unit of food produced: 10 times less energy needed.
  + Most energy intensive countries are Canada and US
    - **But US and China produce the most GHG**
  + How much fertilizer used: Canada: 54kg/ha, US: 103kg/ha, Japan: 300kg/ha
    - Worldwide, Japan uses the most fertilizer
  + what is the underlying ethical framework guiding modern agriculture?

—> technocentric view

* **Meat consumption and the livestock revolution** 
  + CONSUMPTION. Developed countries: 85kg/person/year. Developing: 32kg/person/year
  + Eating at the highest level of food chain
    - This is a bad idea because lots of energy is lost. It is best to eat at the lowest level of the food chain to preserve as much energy as possible
  + 50% of worlds poultry is produced by Canada
  + Shift from family farms to factory farms/feed lots
  + Canada: 43% of worlds beef
  + 2005: 66% of NO2 emissions come from livestock
  + Concerns over having so many animals in compacts spaces
    - In ON and QC there are around 10000 animals per farm
  + Consequence: animal shit not well managed. Mud monkeys enters the fucking river system
    - LMFAOOO ^^^ Bernier will be proud ^^^

Lecture 12

* **Who manages canada’s forests**

· 119 million hectares for timber production

· Provinces responsible for: 77%

· Federal and territories: 16%

· Private landowners: remaining 7%

· Economical maturity is the culmination age 60 to 120 years and more profitable than the ecological maturity

* **Rates of forest conversions**
* **Harvesting systems, the impacts of clear cutting, reforestation; trends** 
  + Clear cutting: worst (but most profitable)
  + Seed Tree Cutting: mimic same diversity, leave seeds for new trees
  + Selective Cutting: selective ages, a mix of trees chopped down (i.e. dying, old, etc.)
    - Selective Cutting cuts the least amount of trees and is best for the environment. However, it requires an expert and is very time consuming…

aint nobody got time 4 dat

* + Shelter Wood Cutting: leave old trees
  + Last 3 methods are the most costly and inefficient… Clear cutting 4 the $$$
  + Clear cutting: size of cuts vary from 15 ha to 250 ha. 90% for harvesting
  + Reforestation: until 1985 it was not needed but now we need it.
  + 2009: less than 450000 planted
  + 2009: 20 million ha removed.
* **Trends in use of biocides** 
  + Biocides used to reduce competition for seedlings by removing the fucking insects/pests
  + Fenitrothion: fatal to kids due to Reyes syndrome
* **Forest fires and the impacts of the mountain pine beetle**

· Suppression in fire-dominated systems has resulted in: uncharacteristic ecological changes

· Ground fuel

· B.C wildfires in 2003

· 1990’s 3.2 m hectares lost to wildfires

· 2001-06: 2 m hectares

· 2009: 0.8 m hectares

Mountain pine beetle

- eats and kills trees

- 30 billion dollars in damages in forest products

- 270 million tonnes of carbon released because of these fucking critters

- 80% of mature pine were consumed by the beetle in BC

* **Forests and species at risk**

· Of species considered at risk in Canada: 65% are forest related

· 85% of species in some forests are bugs

· Over 1,000 species of invasive invertebrates pose a threat to our forests

· The Spotted Owl: Southwestern B.C.

**· THE most endangered species in Canada**

· 2003: 25 breeding pairs left

· 2007: 11 pairs left

· 2011: 6 pairs left (Maybe they just don’t like fucking??? Yet we force them to….)

· They prefer multi layered canopy environments, where their fav food source lives: bushy tailed woodrat

* **Climate change and the role of forests** 
  + 1990: 29 million tonnes released
  + 2009: 18 million tonnes released

Lecture 13

* **Framing questions- aspects that determine how mineral resources**

· Renewable sources: how to manage them so that they remain sustainable?

o Gold quarry

· How to use the proceeds from extraction? ~ Since these resources won't last forever how should we be investing this money for the future generations

· How to extend the longevity of reserves? ~Using the resources as best as possible

· How to minimize environmental impacts? à Exploration, extraction, transformation, consumption, disposal (each of these stages in the life cycle of processes, how we deal with them will decide our environmental future)

· How to create improved socio-economic relationships with stakeholders?

o Elliot Lake, Ontario à uranium (french keyboard much? Lol ;) )

* **Trends in energy use and consumption in canada**
  + Fossil fuels meet 75% of energy needs. Highest production is natural gas
  + Between 1990 and 2000: fossil fuel use increased by 20%
* **Trends in offshore petroleum exploration and issues**
  + Of current world production of petroleum: water, 70%
  + Offshore in Canada: Start in 1992 off the coast of stable Island , Nova Scotia
  + GHG will triple over the next decade to 75 million mega tonnes.
  + Polar regions will be exploited for oil in the very end
* **Athabasca oil sands: context and issues**

· 2nd largest world reserve of petroleum

· 10 to 12% bitumen mixed with sand, clay, silt and water

· By 2013: 55% of Canada's production

· 90% of oil extracted

· To produce 1 barrel of oil it takes up to 4,000 L of water and 1,000,000 L of natural gas is required. Steam needs to be pumped into the chamber to separate the bitumen from the oil

* **Fracking: what is it, and impacts/issues**

· Hydro-fracturing cheaper than oil….release trapped natural gas by use of water (water mixed with chemicals to create fracking fluid therefore impact of this is water pollution)

* Ontario is great for fucking because it has a lot of black shale
  + ^ This was a clicker question...

Lecture 14

* **Trends in energy use/consumption and historical shifts**
* Historical shifts in energy
* 1. Wood
* 2. Coal
* 3. Oil
* 4. Nuclear
* 5. Natural gas
* World energy use and trends – on consumption order
* 1. Oil
* 2. Coal
* 3. Natural gas
* 4. Hydro power
* 5. Nuclear
* 6. Alternatives
* **Trends in use of fossil fuels**
* Coal is most abundant fossil fuels
* o A lot more than oil
* o Mostly found in northern hemisphere
* o Use of coal is on the increase
* Current coal deposits will last 200+ years
* - Bitumen is the most abundant coal but also most dangerous for the environment
* Types of coal → Peat, Lignite, Bituminous, Anthracite

**The future of oil and the potential of other Fossil fuels as replacement; major impacts**

* - High energy content in fossil fuels
* o Efficient to burn, ship and store
* - Persian gulf countries have most of the fossil fuel reserves
* - If we were to continue to use fossil fuels at current rate we will need to find new reserves the size of the Saudi arabia’s reserves every 10 years
* - If Canada continues at the rate we are using and extracting we only have enough for 6 years
* Saudia Arabia has the largest oil reserve… Canada’s is 2nd largest
* Natural gas could be an alternative
* - More natural gas than oil
* - Last another 60 years if we are very conservative.
* - Where ever you can fideo petroleum you can find natural gas as well
* - Use is on the increase
* - Less carbon is released than petroleum
* - Liquefied petroleum gas: butane
* - When petroleum deposits are found they are normally covered by natural gas, instead of extracting the natural gas they normally just burn it to get to the petro quicker
* **Conventional alternatives**
* - Biomass: 10% of worlds energy
* - Hydro power 2.2% of energy
* - Nuclear power : 6.3% of worlds energy
* **Transition to renewable sources**
* - Take time to build them up
* o Wind, solar, Geothermal, and tidal are the main ones
* **- Among all the renewables, wind energy is growing the most; very rapid growth in wind energy**
* o Not at the stage where we can phase out fossil fuels and replace them with these
  + We need more government adoption and enforcement
  + Our dependence on fossil fuels is way 2 much

Lecture 15

* **Characteristics of the footprint of cities**
* Urban environment: open systems
* o Consuming lot of food
* o Lots of raw materials
* o Consuming manufactured goods
* o Centres of the economy
* o Most knowledge developed in cities
* o Outputs are GHG, Noise,
* **Trends in urbanization** in last century; rural to urban migration. Rapid growth in urban population
* **Characteristics of urban sprawl**
* **- Leapfrog development → Pockets of developed areas and then barren land**
* - Land patterns: extremely low density
* - Discontinuous development, eg. commercialization sector
* - Uncoordinated land use patterns
* - Based upon car driven transportation
* - Without cars urban sprawl wouldn’t happen (Those fucking cars!!!)
* **Environmental issues with cities; sustainable solutions**
* - Tertiary treatment of sewage: use of natural means of sewage treatment
* - Help to filter naturally
* **Support needed for sustainable**
  + Using a different agricultural system

Lecture 16

* **Trends in urban development**

Today

· As of 2008: more than half of human population lives in urban areas

· Estimated that by 2030: almost 5 billion people will live in urban areas

· Most of em will be from Asia and Africa

Urban Form

· The type and distribution of infrastructure in communities

· Ex. buildings, roads

· GHG emissions

Urban Sprawl

· Areas characterized by: low population densities and significant travel costs

* A car is a must in the suburbs (Commute time is a bitch)

Housing

· 2001: 80% of Canadians lived in urban centers

· Houses have increased in size drastically

* House sizes are increasing and so is energy consumption per person
  + However, # of ppl per house is decreasing

· Low rise

· Low density

· People moving further away from the city closer to sensitive habits (agricultural)

* This is the rise of the suburbs
* **Trends in transportation**

· Low density urban development at the heart of environmental impacts of cities

· Automobile-dependent cities

· Greater travel distances → Greater commute time

· Decrease in transit rides per person

· Growth of travel by cars, SUV’s, light trucks

* **Trends in waste management**

· Montreal and Calgary <1/3 of wastes diverted

· Toronto 40%

· Halifax 55%

· Markham 70% ← Recycles the most and highest in GTA

* **Trends in air pollution and related issues**

· Because of: stricter regulations on car and industrial emissions

· Smog causes: asthma, bronchitis, emphysema

· U of Alberta: 25,000 deaths occur annually due to air quality

· Can lead to heart problems and cancer

· Costing the government 9-15 billion dollars a year on healthcare for problems resulting from air quality

* **What is sustainable urban development and examples**

· Enhanced well being of cities or urban regions

· Includes integrated economic, ecological, and social components

· Maintain the quality of life for future generations

· E.g. Brazil preparing for the Olympics … the idea to develop a city in a more sustainable fashion, even though this did not happen

The whistler challenge

- Whistler receives 2 million tourists annually

- Only about 11 000 residents

- Energy use in tourism regions is usually far greater with other communities of same size

o Little control over travel outside community

- Reducing the footprint

o Move away from busses to hybrid vehicles

o Transport plan: aim to reduce 20% travel within community

o Make the city more compact

o Transfer to natural gas from oil + fossil fuels

* Invest in green energy

Lecture 17

* **The biodiversity: natural vs human- induced extinctions**

•More species are becoming endangered than what is natural   
 •More Parks =/= Adequate protection   
 •Impacts from modern society cannot be excluded   
 •Predation 100% loss   
 •Normal: 62-64% loss   
 •Extinction: a natural process that occurs at certain rates over time, but human activity can influence it and speed things up

* **Economic value of biodiversity; examples**

· Worlds plants never tested for human food, medication, etc. potential: 99.8%

· Of top 150 prescribed drugs in the US: 56% having ingredients from wild species

· Tropical plants: 90% of worlds food supply

· Pollination of plants required for: 30% of all food produced

· $1.2 billion per year for these activities (pollination)

· Fenitrothion use in 1970s

* **Impacts of habitat changes on biodiversity; examples**

· More than 70% of prairie wetlands drained

· Remaining ones affected by farming

· 33% decline in number of ducks in May ponds in the Southern Prairies since 1960s

* **Global and canadian responses to biodiversity loss; acts, agreements, and examples**

· CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

· - Ex. orchids, parrots, rhinos are protected by this

· Ratified by 120 countries

· CITES: instrumental in restricting trade in certain endangered wildlife species ex. Ivory

· Canada has had weak support of cites

· Failure to pay dues

· 1992 CBD: Convention on Biological Diversity

- COSEWIC - determines the state of rare species and their extinction, but does not guarantee protection (i.e. Atlantic COD)

- - Scientists determined if there is less than 1000 breeding pairs, they should be listed as threatened

SARA and Politics

- species at risk act mandated in 2002

- Listing processes is impacted by political decisions

o Atlantic cod

§ Less than 1% less

§ They are listed as endangered even though they will not be able to recover

o Polar bear

§ Delay because they are in the north

§ Nunavut didn’t have the money to come up with a solution so they opposed it being lifted

* Spotted owl is the MOST endangered species in Canada

- In 2006: 11% of species proposed for listing under SARA based on biological grounds were rejected under other grounds

· World Summit on Sustainable development, in Rio

· Canadian Biodiversity Strategy 1995

· Canada: first to sign

* **The role of national parks** 
  + Banff, 3 times larger shopping space than toronto
    - Fuck is a Banff?

Lecture 18

* **Global perspectives on environmental changes**

· Slow progress in implementing targets

· Marine Protected Areas

· Completion: 2085

· This is 30 years after the global fisheries would collapse (lmao, excellent protection)

· Slow progress in implementing targets

· Sustainable fisheries

· 7% of the world’s fisheries

* **Rise of consumerism**

•25% of humanity now within the consumer class   
 •US houses were 38% bigger in 2002 than in 1975

* **Global trends and ecosystems services**
* **-**  MEA: out of 25 major ecosystem services supporting – 15 are being pushed beyond their limits and exploited
* - Degradation cannot be seen outside human context
* - Slow progress in accomplishing international agreements
* **The MDG goals, human development index and resource consumption what’s MDG**
* **State of the environment in canada**
* **Canada’s record with environmental agreements and policies**
* **Individual actions, corporate responsibility, and governmental accountability**

Individual Actions

· Practice the 100 mile diet

· Implementing the 3 R’s more

Corporate Responsibility

· Retailer leading the way to more sustainable way of doing things

· Life Cycle of Assessments (LCA): tracking the inputs, outputs and impacts of a product ex. Volvo does this

Government Accountability

· Governments make decisions that can promote sustainability

· Ex. design of infrastructure, invest in green energy

**Bernier released the specific key concepts from the modules he will be testing us on. So the ones written in purple below will be on the exam! God bless Bernier**

**Key Concept from Modules**

2 Ecosystems and Biodiversity

* What is energy, and its different forms
  + Energy is the capacity to do work
  + Different forms: radiant energy (sun rays), energy in chemical bonds, heat (movement of atoms), electric, mechanical which can be either potential (stored energy available for later use) or kinetic
* What are the laws of thermodynamics
  + 1st law: is the law of conservation of energy- energy cannot be created or destroyed, just transformed from one form to another
  + 2nd law: tells us that when energy is transformed from one form into another, there is always a decrease in the quality of usable energy; some energy is lost as lower quality, dispersed energy to the surrounding environment, often as heat
* high-/low-quality energy
  + Most of the energy available for use is low quality energy – dispersed at low temp. and difficult to gather
  + Total energy of all atoms is known as heat
  + Majority of energy is low quality
  + High quality energy like coal or fire is easy to use but disperses quickly
* Which forms of energy are predominantly used in our society
* Different types of organisms involved in energy transfer, in ecosystems
* Food webs and food chains
  + Most complex food webs exist in most favourable conditions for life
  + Debate whether webs are controlled by the predators (top down control) or by prey (bottom up control)
  + Decomposer food chains and based on dead organic material
  + Are just as important as grazer food chains
  + Necessary to break down dead organic material
* Biomass pyramid
* Differences in productivity between ecosystems
* - Rate at which energy is changed to biomass is expressed in kilocalories/sqmeter/year
* - GPP – gross primary productivity
* - Cellular respiration (R) is the metabolic cost and should be subtracted from the GPP to get the NPP = Net primary productivity which is amount of energy available to heterotrophs
* - Wetlands and Tropical Rainforests – most productive
* - Open Ocean and Deserts – least productive
* Ecological succession
  + Is the gradual replacement of one assemblage of species by another as conditions change overtime
* Primary and secondary successions; different types of climax
  + Primary succession is the colonization and occupation of a previously unvegetated surface, where little or no soil exists
  + Secondary succession is the sequential development of biotic communities on previously vegetated surfaces that have soil cover, and that have been disturbed, e.g a forest after a wildfire
* Disturbance
* Immature and mature ecosystems
* Dynamic equilibrium
* Levels of organisation in ecosystems
* Biomes and ecozones; soil systems
* Abiotic factors and their impact on ecosystems; the limiting factor principle
* Keystone species and superabundance
* - Removal of species from food webs can disturb the ecosystem
* - Keystone species – have influence on the whole community
* o For e.g. beavers which modify the hydrological regime at locations
* - Hyperabundance – when a species grows dramatically due to loss of predator or natural habitat has been disturbed
* Feedback loops
  + Positive feedback loop are self-amplifying cycles (exacerbation/increase)
  + Global temperature increase à more ice coverage melting à less cooling effects from ice coverage à global temperature increase
  + Negative feedback loops are self-sustaining cycles (moderation)
  + Ex. Phytoplankton levels increase with global temperature increase à phytoplankton produces sulfide à sulfide increases cloud coverage à reduces sun rays hitting the earth à mediates temperature increase
* Population change and growth
* Population dynamics and carrying capacity; dependence on density
* R- and k- strategists
  + R-strategists
    - Produce large # of young, but little parenting
    - Ex. Insects, rodents, fish
    - Usually small and short-lived
    - Quantity over quality
  + K-strategists
    - Produce few offspring, but invest a lot of time/care
    - Ex. Large mammals (including humans)
    - Usually live longer and are larger
    - Most endangered species are k-strategists
* Natural selection, different forms of evolution and extinction

1 Environment and Resources

* Change in natural systems: timescales involved, types of changes, examples
  + Are abrupt and happening faste
  + Examples of natural changes; cold, glacial periods, warm interglacial periods
  + E.g. global warming
* Types and examples of societal changes
* Major challenges that society faces as a result of environmental change
* The Millennium Ecosystem Assessment, its findings, and the development goals
  + The Millennium Ecosystem Assessment was called for by the UN Secretary -General Kofi Annan in 2000
  + It was carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being
  + Involved the work of more than 1,300 experts from 95 countries
  + Findings provide a scientific appraisal of the condition and trends in the world’s ecosystems; and options to restore, conserve or enhance the sustainable use of ecosystems
    - Here are some highlights of the findings made by the Millennium Ecosystem Assessment
      * One of them is a change in the structure and function of ecosystems, e.g.: more land was converted to cropland in the 30 years after 1950 than between 1700 and 1850
      * Cultivated Systems in 2000 cover 25% of Earth’s terrestrial surface
      * They are Defined as areas where at least 30% of the landscape is in croplands, shifting cultivation, confined livestock production
  + The experts concluded that many of the changes are non-linear and once they start, the processes of degradation will increase rapidly
* The impact of population of growth
* The relation between economic growth and the demographic transition
* What is the environment
* What is a resource and examples
* The different perspectives on what constitutes a resource
* - Anthropocentric View - Resources are valued only with respect to human utility
* o Coal and copper were not considered resources until they were found useful
* - Biocentric view – resources exist independently from human desires
* o Grizzly bears have intrinsic value
* o Biocentric view is within the ecocentric view
* The different approaches to understanding the environment, and our relation to it
* - Disciplinary approach – organized around concepts of a given discipline
* o For e.g. we can look at a problem through a biological or chemical view breaking it down to components, also called a reductionist view
* - Multidisciplinary approach – synthesis occurs after individual studies have been completed, combining disciplinary approaches
* - Cross-disciplinary approach – researchers actively use knowledge from another discipline to enhance their perspective
* o E.g. soil specialist using plant-based knowledge
* - Interdisciplinary approach – specialists from separate areas actively working together from the beginning
* o Takes a lot of time and money
* - Transdisciplinary approach – the subject is not the domain of a particular discipline
* o Can enhance understanding or misinformation overload can lead to confusion
* o It includes equally important information from environment, social and economic areas of research
* The aspects to be considered for science based management of the environment
* Sustainable development and livelihoods
* - Meets the needs of the present without compromising future generations
* - 3 strategic aspects – economy, environment and social community
* - Critique – too anthropocentric
* Resilience
  + Is the ability to absorb disturbances and still retain its basic function and structure
* Environmental indicators and their use
* Ecological footprint and the living planet index
  + Ecological footprints measure the human use of the environment in hectares per person
  + The living planet index, created by the World Wildlife Fund, is a widely used index that tracks 1,313 vertebrate species
* Rate of resource consumption

3 Ecosystems and Matter cycling

* What is matter, and its constituents
* What is the law of conservation of matter
  + States that matter can neither be created nor destroyed, but only transformed from one form into another
* Different forms of matter
* What are biogeochemical cycles, how they work, their different types, and the different types of nutrients
* The importance of phosphorus; the major features of its biogeochemical cycle, and the associated environmental impacts
* - macronutrient
* - relatively rare on the Earths surface in relation to its biological demand
* - is the dominant limiting factor in freshwater aquatic ecosystems and for plant growth in terrestrial soil hence the need for use of fertilizers heavy in Phosphorus
* - phosphorus is a main determinant of global futures because it ultimately controls in nitrogen and carbon cycles in the ocean
* - availability of phosphorus in the soil is influenced by soil acidity and it gets bound into insoluble compounds under very acidic and very basic conditions
* o acid precipitation limits P availability
* - rocks in the Earth’s crust are the main reservoir of phosphorus
* o animal wastes and decomposition also provide P
* - P is taken up by plants and removed by water transport
* o Transport of P and other nutrients into stream and then lakes and oceans enhance the productivity of estuaries and other coastal ecosystems and enter the oceanic food chain via uptake by phytoplankton
* - Guano -> marine food droppings that return P to the land
* - Humans are the major cause for eutrophication on freshwater systems
* The importance of nitrogen; the major features of its biogeochemical cycle, and the associated environmental impacts
* - Nitrogen fixation and denitrification through microbial activity links the atmosphere and biosphere
* - N is a limiting factor in terrestrial soils
* - Bacteria of the Rhizobium family are important nitrogen fixers that grow on root nodules of plants
* - Mineralization – decomposing biomass is converted to ammonia salts and ammonium salts by microbial activity and returned to the soil
* - Nitrification – Ammonia and ammonium is converted to nitrates and nitrites
* - Denitrification – Nitrites and Nitrates converted to nitrogen gas
* - Nitrates are highly soluble in water creating dramatic loss in surface runoff
* - like phosphorus, it is a limiting growth factor and a major cause of eutrophication
* - unlike phosphorus, it has a good cycling mechanism and is not immobilized in deep ocean sediments
* The importance of carbon; the major features of its biogeochemical cycle, and the associated environmental impacts
* - atmosphere is the main reservoir for essential carbon
* - the ocean’s capacity to store carbon dioxide may be decreasing under increased atmospheric carbon dioxide
* - Carbon is stored the longest in oceans through the death of marine organisms with calcium carbonate shells
* The importance of the hydrological cycle; its major features, and the associated environmental impacts
* What is eutrophication, its causes and effects, and the solutions to the problem
* What is acidification, and the impact on ecosystems

4 Environmental Planning and Management

* Long term and short term views in environmental planning
* Social learning; single-loop learning; double-loop learning
  + Social learning is learning applied not only to individuals but also to social collectives, such as organization and communities
  + Single-loop learning: the emphasis is to ensure a match between intent and outcome
  + Double-loop learning addresses a condition, when there is a mismatch between intention and outcome
* The concepts and philosophy of environmental planning
* What is context and its importance in environmental planning
  + Context are the specific characteristics of a time and place
* The current context in which environmental planning is occuring- the major points of the Big Picture
* Ingenuity Gap
  + Refers to the mismatch between the supply of ideas needed to fix environmental problems and the availability of such ideas
* What is the ecosystem approach and its characteristics
  + An approach that was developed to address common environmental management problems
* Opportunities and changes in perspective that the ecosystem approach imposes

5 Planning and Management Process

* The Rungs on the Ladder of Citizen Participation
* Stakeholders and their role in participatory approaches
* collaboration, coordination, and their place in the shared management of resources
* The issues around the communication of environmental science issues to the public
* 3 main purposes for scientific communication for environmental issues
  + o Raise Awareness
  + o Come to an Understanding
  + o Motivate Action
* Turbulence
* Adaptive management
  + Develops policies and practices to deal with the uncertain, the unexpected, and the unknown
  + Is mainly concerned with learning-by-doing in a scientific way to deal with uncertainty
* Environmental impact assessment and risk assessment
  + EIA is the part of the impact assessment that identifies and predicts the impacts from the development proposals on both the biophysical environment and on human health and well-being
  + RA underlies impact assessment, since it focuses on determining the probability of an environmentally or socially negative event of some magnitude, like an oil spill
* Precautionary principle
* o Guideline stating that when there is a possibility of serious or irreversible environmental damage resulting from a course of action, lack of scientific certainty is not an acceptable reason for postponing a measure to prevent environmental degradation or for assuming that damage in the future can be rectified by some kind of technological fix
* Strategic environmental assessment and what it involves
* Conditions under which an assessment should be done, and the involvement of the public
* Why do disputes over resources occur
* The issues at the centre of the approaches to handling disputes
* Judicial resolution
* The characteristics of methods of alternative dispute resolution
* Public consultation, negotiation, mediation, arbitration
* Public consultation : partnership & delegated power
* Negotiation: when two or more parties involved in a dispute join in a voluntary, joint exploration of issues with a goal of reaching a mutually acceptable agreement (participants can withdraw at any time) One of the two main types of alternative dispute resolution
* Mediation: Negotiation process guided by a facilitator or mediator (2nd main type of ADR)
  + Mediator task is to help parties involved overcome their differences and reach an agreement
  + No power to impose any outcome
  + Stakeholders are responsible to accept or reject any solutions to the dispute and mediator has to be acceptable to all parties
* Arbitration: Involves stakeholders to select a third party to listen to the views and interests of the parties in a dispute & make a solution to be accepted by the participants and it is usually binding (arbitrator is chosen by

6 Climate Change

* What is the difference between weather and climate
  + Weather is expressed by a combination of several elements, mainly temperature, precipitation and humidity. The weather of any place is the sum total of its atmospheric conditions(temperature, pressure, wind, moisture, and precipitation) for a short period of time
  + Climate is the composite of the variety of day-to-day weather conditions
* What is climate change
  + A long-term alteration in the climate of a particular location or region for the entire planet
* What causes climate change
* What are the indicators of past climate conditions
* The different lines of evidence, of ongoing climate change
* The intergovernmental panel on climate change
* The scientific explanations of climate change
* Implications of climate change for ecosystems
* - Climate change may lead to the boreal forest moving north
* - Northern movement of treelines will threaten the existence of national parks and its inhabitants as well as breeding capacities
* - Canada could be one of the rare countries to benefit from global warming as it will extend growing seasons and decrease risk of severe cold conditions
* - Southern Canada would get wetter and lakes might drop in water level negatively affecting fish species as well boat loads
* - Warmer climate might increase temperature and sea level
* o E.g. Maldives could be completely flooded by 2050
* - IPCC predicts greater disease in Canada however
* o West Nile, Lyme and Dengue
* Implications of climate change for services provided by ecosystems
* Forms of societal responses and adaptation to climate change
* Difficulties in communication the science of climate change to the public
* Uncertainties and views challenging science
* The issue of the great impacts on less-developed countries
* The relation between climate change, lifestyle and policy options

All of the key concepts below are on the Exam:

7. Oceans and Fisheries

* The link between oceanic ecosystem productivity and currents
  + The highest productivity on continental shelves exists at depths < 200 metres, where most fisheries occur
  + Upwelling occurs as winds blow parallel to the coasts, cool water rises to the top and brings nutrients that trigger algal bloom
* Canada’s oceanic ecozones
  + Pacific Ocean: wintering ground of important populations of seabirds and marine animals
    - Pollution nearby due to paper mill discharges
    - Areas closed to shellfish harvesting
    - Oil spills have caused bird deaths
    - Populations of sea lions and seals have yet to recover from hunting
    - Sea otters have been extirpated
    - Invasive species of green crab which affects shellfish populations
  + Arctic Basin: largely covered by permanent ice packs
    - Marine species live at margins of ice packs, ex: beluga
    - Most abundant species: ringed seals, well adapted to arctic conditions, food source: krill
  + Arctic Archipelago: characterized by *polynyas*- areas of permanent open water
    - Polynyas are biologically productive areas
    - Inuit fishing grounds
  + Northwest Atlantic: covered by ice during the winter
    - Higher temp. than Arctic b/c of warm currents
    - Ground of seal hunt
  + Atlantic: ice-free
    - Supports abundant population of seabirds ex: Northern Gannet
    - Abundant population of coral reef ex: Gorgonia, nursery grounds for many fish, sensitive to temperature and chemical conditions.
      * Expected to be the first corals to disappear with the acidification of the ocean
    - Major ground for oil exploration ex: Hibernia oil field
* Different types and approaches to fisheries and their impacts on the oceans
  + Artisanal Fishing: small scale, shifted away from in the past 50 years
  + Factory Fishing: large scale
    - Longline fishing: millions of sharks and seabirds have unnecessarily caught
    - Bottom Trawling: heavy nets dragged along the bottom to catch benthic or supra-benthic species
      * Destroys benthic habitats
      * Caused damage to more than half the seabeds in certain areas ex: sponge reefs off coast of BC
      * Federal government has closed certain areas to trawling after voluntary restriction failed
      * Used for shrimp fishing, net drags along the floor and scoops everything
      * Indirect impact on species that feed on commercialized fish ex: Steller sea lions forced to feed on less energy efficient prey since cod is no longer available

Water

* Contamination of the water supply in Walkerton
  + Contamination by E. coli in 2000
  + Community of 5000, 7 people died, 2300 ill
  + Public inquiry by Justice O’Connor established that:
    - A well had been contaminated by manure
* The Red River Flood, 1997
* o Grand Forks was flooded
* o Per capita, it the most costly flood for a metropolitan area
* o Caused by high precipitation in 1996, and a very long winter
* o Winnipeg was slightly protected due to a floodway built prior
* Proposed water diversions schemes to the United States
* - Diversions are completed to increase the water supply to a community or region
* o St. Mary’s Irrigation District
* - To deflect watercourses away from or around areas to be protected or drained
* o Portage Diversion in Manitoba
* - To enhance river capacity to facilitate shipping, waste disposal or fish habitat
* o Dams on the Ottawa river
* - To consolidate water flows for hydroelectric generation
* o James Bay Project
* Issues and History of the James Bay Hydroelectric Project
* o To meet future electricity needs in Quebec
* o Rivers on the eastern side of James Bay would be used to channel water in the La Grande River Basin which produced energy covering 1.5 of Quebec’s surface area
* o Mercury levels were a big concern for the Cree people inhabiting the area and fishing
* The Soft Path to water management
* - Soft Path aims to improve water use efficiency by challenging basic patterns of consumption and asking why we are using the water
* Hydro Solidarity
* - Hydrosolidarity is an approach that recognizes the many interconnections between resource systems and managing them in the interests of all parties involved including upstream and downstream residents.

Impacts of Agriculture

* The Green Revolution and approaches to Increase Yields
  + Increase yields by increasing the intensity and frequency of cropping, planting selectively bred and genetically modified seeds
  + 1st Green Revolution- took place in the 1950s in developed countries
  + 2nd Green Revolution- took place in 1967 and onwards in developing countries
* The Effects of modern, industrial-scale Agriculture on Soils, Water, and Human Health
  + Soil- loss of fertility and erosion; salinization; waterlogging (saturation of water in soil) and desertification
  + Water- increased runoff and flooding due to land being cleared to grow crops; increase in the number of fish deaths due to pesticide runoffs
  + Human health- nitrates in drinking water, bacterial contamination of food supply, contamination of drinking/bathing water by livestock waste, pesticide residues in drinking water, food and air

Agriculture

* Soil Salinization
* The deposit of salt in irrigated soils making most of it unfit for most crops to grow
* It is caused by rising water table due to inadequate drainage of irrigated soils
* Irrigated soils are less productive world wide
* When water evaporates it leave behind dissolved salt and it accumulates over time and may render the soil unusual
* Worse where vegetation is removed
* Surface evaporation increases and salt concentration at the surface
* Summer fallow: management practices in the Prairies where is land is ploughed and left bare to reduce evapotranspiration but results in increased salinization
* Crop yield decreases up to 75%
* The economic geography of Agriculture in Canada
* 7% of Canada’s total land area is agricultural land, this number has stayed consistent in the past 50 years
* The agriculture and agri-food industry is a $86 billion industry, exporting more than $28 billion worth of product
* - 7% of Canada’s total land is agricultural land
* - Wheat is the dominant crop in Canada
* o Saskatchewan accounts for the majority of this production
* - Food production in Canada used to employ about 80% of the population and now it is only 3%
* - Potatoes are the most extensively grown vegetables in Canada
* - Blueberries dominate fruit production
* - Less farms are being built but existing ones are getting expanded
* - Nearly 90% of the prime agricultural land is located in southern Canada
* Issues related to the non-selectivity of Biocides
* Estimated that in Canada and US, 900 major agricultural pests are immune to various types of biocides  
  Many biocides are a broad spectrum poison which will kill most insects (no need to select which one to kill)  
  Therefore they not only kill targeted species but also valuable ones that may control pests  
  Examples:  
  Endrin used to kill rats but also kills minnow  
  Heptachlor: used to control termites but has reduced breeding of sparrows  
  Carbofuran: used against grasshopper but exists in two forms: liquid and granules. The granules are attractive to birds that may confuse them as grit to grind food when eating. Also, when fields are flood the liquid form is exposed to the birds
* No-till/Conservation Agriculture
* Ploughing used to destroy weeds: loosens topsoil for water to infiltrate for initial crop development
* Disturbance of topsoil leads to: soil erosion, soil compaction, destabilization of soil structure and loss of productivity
* No-till/Conservation agriculture: zero, minimum to low tillage on the soil to protect and stimulate its biological functioning while maintaining and improving crop yield. Ex: direct sowing and drilling rather than ploughing, maintenance of permanent cover of plant material and crop rotation
* Crop rotation: alternate cropping to help restore soil fertility and control pests
* Strip cropping: similar to contour cropping. When different crops are planted in strips parallel to the slope. Alternate strips of grains or forage crops. Is more effective in reducing soil losses.
* Combines soil conservation and moisture properties plus crop rotation properties.
* Contour cultivation: plant in parallel from the contour of the slope. Reduces the speed of soil runoffs
* No-till: disturbs the soil even less.  
   - Rise in no till farming in canada  
   - Placing Seed, manure or fertilizers with minimum soil disturbance

Forests

66% of species in Canada found in the forests

* The Geographic Distribution of Canada’s Terrestrial Ecozones

8 major ecozones: dominated by wetland, glaciers, rocks, forests, woodlands and lakes:

* Boreal Cordillera: northern BC and southern Yukon
* Pacific Maritime: stretches along the entire BC coast and is influenced by Pacific Ocean
* Montane Cordillera: southern BC
* Boreal Plains:extends from the southern part of Yukon into southeastern Manitoba
* Taiga Plains: east of Northwest Territories
* Boreal shield: largest ecozone in Canada. Stretches from Saskatchewan to Newfoundland. Extending across North America and Eurasia
* Mixedwood plains:most urbanized. Stretch from lower Great Lakes north to St Lawrence valley
* Atlantic Maritime : mouth of St Lawrence River across New Brunswick, Nova Scotia and PEI
* The importance of Canada’s forests to its landscape and economy
* ⅓ of world’s Boreal Forest in Canada
* ½ of is 50,000 hectares of land that has still not been disturbed
* Boreal shield in canada (58% of Canada’s landmass): ¼ of the world’s remaining original forests
* Forest: wide diversity of aquatic and terrestrial wildlife
* Commercial activities: logging, wood fibre, sawlog production, pulp and paper mills and fibreboard production.
* 50% of boreal forest allocated to industry
* Intensive forestry and how it is practiced, and the parameters guiding it
* Leads to simplification of forest ecology: genetic, structural and successional level
* Emphasizes on short term economic maximization
* Annual Allowable cut (AAC): the amount of timber that is allowed to be cut/year from a specific area (Each province has a AAC)
* AAC should reflect the Long Run Sustained Yield (LRSY or what land yield in perpetuity) of a given land unit
* Old growth forest have higher timber volumes resulting in AAC that has 30% low as old forests are eliminated
* Second growth timber has much lower volumes
* Determinants of AAC: Important to consider forest’s rotation period and difference in amounts of old growth and second growth
* Differences between managed forest ecosystems and unmanaged ones
* Unmanaged Forest:
  + Old growth forests
  + trees that span several centuries
  + Contain high value timber and large amounts of carbon
  + This is a natural and complex system.
  + Nutrient cycle and natural processes are balancing
* Managed Forest
  + harvest
  + Cultural and simple systems.
  + Reduction of species and genetic diversity
  + Reduction due to plantations selected for desirable characteristics
  + Forests are more susceptible to pests because they are less able to adapt
  + Harvesting removes nutrients from the site
  + Maximizes short term yield
  + But may compromise the sites ability to produce further harvest
* Strategies and initiatives to manage forests sustainably, and trends
  + Canadian Council of Forest Ministers created the National Forest Strategy
  + Canada is the first Country in the World to develop a National Forest Strategy
  + Established in 1998-2003
  + Priorities: transformation of forest sectors & Addresses climate change
  + Includes all stakeholders, all forest ministers (provincial, federal and territorial level)
  + Success: development of a system model forests in the major forest regions
  + Program ended in 2007 and replaced by Forest Community Program (help communities make the most of resource based economic opportunity)
  + Issues of the NFS: 9 strategic directions and 121 commitments (far too many)
  + NFS said to have negligible impacts (lack of inclusion)
  + UN conference on Environment and Development (UNCED): failed to establish an international convention on forestry
  + Growing trend of certification by the Forest Stewardship council, The Canadian Standard Association, And the Sustainable forestry initiative

Minerals and Energy

* Alberta has the greatest increase of energy use
* Fossil fuels are our major sources of energy and they emit GHGs
* Renewable and nonrenewable
* Distinction between Occurrence:
* Transferability: the distance over which an energy source may be transported is a function of its physical form, energy content, and transport technology
* energy content: is the amount usable energy by weight or volume of a given source
* Reliability: Uninterrupted availability gives one source an advantage over a source with intermittent availability
* Storability: To meet interruptions gives one source an advantage over source with intermittent availability
* Flexibility: the greater the variety of end uses to which a given source of form may be put more desirable it is
* Price: A less expensive source or form will be preferred over the more expensive
* Safety and impact: Sources that may be produced or used with low risk to human health and the environment will be preferred over less benign sources
* Cleanliness and Conveniences: A cleaner and more convenient source will be preferred over a dirty and the cumbersome source
* Distinction between Flow and Stock Resources
* Flow resources:
  + Renewable resources
  + Renewed naturally over a short period of time
  + Critical zone resources (fish, forests, etc) can renew themselves as long as humans let them regenerate and reproduce
  + Can be harvest or exploited to exhaustion: overfishing
  + Can be over used to exceed capacity to regenerate thus becoming a stock resource
  + Non critical zones (solar energy, wind, waves, etc)

- stock resources are nonrenewable:

- only changed from one form to another

-fossil fuels

- polluting but sometimes can be recycled

* Major non-renewable resources in Canada: potash, coal, uranium and nuclear power
* Canada one of the largest exporters of minerals
* Canada one of the largest producer for coal

Minerals:

Potash:

* Canada largest exporter and producer of it globally
* Saskatchewan’s Potash industry is the most productive worldwide (high in quality and extraction is easy)
* Includes various salts of potassium (potassium chloride: the most important)
* Potassium (k) used in plant growth and 95% of k produced is used in fertilizers

Coal and uranium makes ⅓ of energy production for canada

* Alberta produces 50% of coal in canada and depends on it for 50% of its electricity
* By the end of 2001, 21 coal fired power generation plants were working in canada accounting for 90% of consumption of coal in canada

Uranium

* Mining for it Was developed in 1940s to make bombs
* Processed uranium used to fuel nuclear reactors for electricity
* Canada is the world leader in mining Uranium (largest mines: Saskatchewan and Ontario)
* Mining: economic growth and jobs

Nuclear power

* Example: Pickering Nuclear Power Plant
* Challenge to store nuclear fuels because wastes are highly radioactive
* Canada produces 12% to 15% of its electricity from nuclear power
* Canada well known for CANDU reactors (canadian deuterium uranium)
* Low operating and emission costs
* Meets electricity demands (key strategy of canada)
* Nuclear Waste Management Organization (NWMO) identifies options of storage and disposal of nuclear waste
* Identified a hybrid storage option: adaptive phased management (technical methods and management systems)

Energy

* Impacts and challenges in using coal and natural gas

Coal:

* Most abundant fossil fuel
* Reserves could last 200 more years
* It is found in the Northern Hemisphere and US has 25% of it
* Anthracite (hard, variety of coal) : limited in supply but most desirable because of high heat and low sulphur content

Environmental impacts of coal:

* Abandoned mines
* Acid mine drainage and oxidative products are washed into streams and lakes
* Acid deposition and mountaintop removal (15-25% of mountaintops of S. West Virginia are affected)
* Valleys filled with tailings and debris
* CO2 release

Natural gas:

* More plentiful than oil
* Unlike coal methane that leaks into the atmosphere when mined natural gas is simply burned off
* 25% of global commercial energy consumption
* Will Last ~60 more years
* Advantage: less pollution emitted during transportation
* Disadvantage: deposits are far from usage points (in US ~100,000 vehicles needed). Transport is difficult because Natural gas is explosive. Deposits require offshore drilling to obtain. Not enough equipment.
* New Renewable Energy Resources: solar, wind power
* “New” because not yet used on a wide of scales
* Will play bigger role in future energy use
* Technologies are still developing
* Ex: solar energy, wind energy, geothermal energy
* Wind power is the fastest growing
* Use has expanded quickly due to concerns over diminishing fossil fuels and its negative environmental impacts
* Advances in technology makes it easier and less expensive

Advantages: create jobs, alleviate pollution and ghg emissions, diversify country’s energy economy

Sustainability and Cities

* Patterns of urbanization at the global scale and in North America
* Urban environments are open systems
* Largest urban centres are located in coastal areas
* The projected growth rates are expected to be most significant in developing world
* Major cities are social and economic magnets for rural population: example New York and Chicago
* Their economies have rapidly diversified and boundaries of larger cities have become blurred
* Suburbs: “new haven” or new nonrural environments
* Green architecture: structures are built using environmentally responsible and resource-efficient processes throughout a building's life-cycle
  + Ex: Hearst Tower, New York

Urban Environmental Management

* Trends and Patterns of Urban Development

Urban form: types and distribution of infrastructure in cities

* Key to influencing environmental quality
* Transportation configurations impacts energy use
* Building design affects energy efficiency
* Energy use affects GHG emissions

Urban sprawl:

* Areas with low population density but high travel cost
* Loss, disruption and degradation to nearby agricultural land, environmentally sensitive areas, water, air and natural habitats

Compact urban form: most environmentally desirable

Number of houses have increased but the number of people living in ti has decreased as a result:

* Space and energy use/person increasing significantly (Major areas: Golden horseshoe, lower mainland in BC, the montreal region and the calgary-edmonton corridor)
* 2001: 80% of canadians lived in urban areas
* Automobile dependent cities because city centers are further away (ghg emission)
* How the environmental problems caused by cities can be addressed by Best Practices in Urban Development

Best Practices:

Smart growth; development practices: (eg. crescent village =, Oregon)

* Reduce urban sprawl
* Use tax dollar more efficiently
* Make communities more livable
* Walkable urban centers

Ecosystem approach:

* Create regional manager Based on landscape features

Air quality:

* Use energy efficient vehicles
* Developing renewable energy
* Convenient public transits
* Reduced energy use
* Eg. Chicago requires all their houses to meet the silver standard of LEED (Leadership in Energy and Environmental Design)
* How to address sustainability in cities issues such as transportation, energy use, waste management, the urban heat island effect, and the hydrological cycle

They include

Facilitating teleworking and teleservice to

reduce travel time; encouraging carpooling programs;

initiating transit pass programs that provide seamless

transition between components, e.g. a single pass that

allows to use the train and transit at the same time;

facilitating the use of bicycles and other means with a

small ecological footprint

***LECTURE NOTES: (do we need to study the notes from the lectures?? because we are only getting tested on the key concepts from lectures/modules) He said only the key concepts (from lectures and modules) are on the exam, so we should focus on those***

**Lecture 1:** we did not need to know this lecture for the exam!

**Lecture 2:** *Environment, Resources, and Society*

**The Global Picture**

* Canada, compared to other countries in terms of its ecological footprint, is 3rd highest.
* Humans have depended on oceans almost as an infinite supply of food.
  + Now we’re facing the possibility that our seas will no longer be this source of food
  + Certain fish that have been part of our diet for many many years are no longer found
* Forests are disappearing
  + Could be due to forest fires
  + Deforestation and logging also play a role
  + Nothing new but the rate at which this is happening now is much higher than what we have seen before
* The amount of greenhouse gases that we have released through various activities has been increasing

**The Impact of Population Growth**

* Less developed countries predicted to grow by 33% between 2005 and 2050
* India predicted to overtake China as most populous country

**The Impact of Consumption**

* Global energy consumption increased `12-fold between 1850 and 1970
* The most industrialized countries tend to be the ones that use the most energy
  + Wealthiest countries: 25x more energy/capita than poorest countries
* Our governments provide quite significant subsidies for energy consumption (oil/gas companies)

**Ecological Footprint**

* Measures: The human use of the environment in hectares per person
* Canada and the U.S. rank among the most consumptive of resources
  + New Zealand is the highest
  + Canada is third highest

**Ecological Footprint**

* Available: Only 1.7 gigaECT AiRS/person
* Used: 2.8 gigahectares/person
  + The carbon footprint is one of the highest
  + Between 1985 and 2012, there has been a drop - largely due to the economic outrun
  + The middle income countries see a rise
    - Some of the most populous countries are among the middle income countries
* 20% of the world’s population consumes 75% of the world’s resources
  + We use resources from other countries
* Biocapacity: the amount of biologically productive area available to meet humanity’s needs
  + Biocapacity is assumed to fall to the productivity level of 1961 or below if overshoot continues to increase.
  + This decline might accelerate as ecological debt grows and these productivity loses may become irreversible.
* By the late 20th century, it was found that biocapacity exceeded by 25%

**Beyond the Boundary**

* Our planet provides us with different services and when looking at our planet’s ability to deal with this, there are limits we need to be aware of.
* We are exceeding our planet’s ability to deal with climate change, biodiversity loss, and nitrogen cycle.
  + We are pushing our planet’s boundaries
* This has led geologists to call the age that we are living in anthropocene
  + When humanity drivers most biophysical changes
* Humanity, rather than environmental and natural processes, and driving changes in our ecosystems.
* Certain areas like the Easter Island, Maya, Norse, Greenland, and Anasazi:
  + Did not anticipate a problem
  + Did not anticipate its severity
  + Neglected to address a problem
  + If they tried, they failed when trying to solve it
* There have been some efforts globally to address these environmental issues

**What is Canada’s Impact**

* Carrying capacity:
  + Maximum population size that a given ecosystem can support for: An indefinite period or on a sustainable basis
    - If an average Indian was consuming as much as an average Canadian, we would need 4 planets to function
    - Canada is the highest producer per capita of waste products
      * This puts more pressure on the ecosystems and generates worldwide poverty
* Richest Canadians: Largest ecological footprint
  + People who have the lowest incomes have lower footprints whereas people who have the highest incomes have footprints that are larger than 12
  + As of 2008, people with the highest incomes make more than $155,000/year
* Canada should have the highest score for the environmental awareness in the consumption habits of its citizens.

**Who is Responsible for the Environment in Canada?**

* Federal, Provincial, and Municipal roles
* The government is going to listen to stakeholders and make decisions

**Lack of Progress Towards Sustainable Development in Canada**

* 1997: Commissioner for Environment and Sustainability noted aspects where improvement was necessary:
  + Implementation gap
  + Lack of coordination and integration
  + Inadequate performance review
* 2016: Commissioner’s report indicated very little progress: Made in implementing sustainable development strategies - 8 years after made into law
  + The provinces have different mechanisms to deal with this

**Plan for Hamilton’s Randle Reef Cleanup**

* Plan - Put coal tar “in a big steel box”
  + CBC News, December 19, 2012
* Federals commit to Hamilton Randle Reef clean up project
  + CBC News, December 18 2012
* Areas of Randle Reef are highly contaminated
  + Took about 30 years to address and take action against the problem, $140 million

**Conclusion**

* Due to human activity, our global support ecosystems are changing at fast rates
* Accompanied by an increase of our global ecological footprint, the world’s biocapacity is diminishing
* In Canada, the responsibility of developing our country more sustainably is shared between a patchwork of governments - with little to show for it so far.

**Lecture 3:** *Ecosystems and Biodiversity*

**Lecture 4:** *Ecosystems and Matter Cycling*

**Lecture 5:** *Environmental Planning and Management*

Trends since the early 1990’s

1. preoccupation with debt reduction

* trying to solve major issues after 2nd world war, trying to pay this back. we pay for thsis debt
* wildlife association
* wildlife and changes in the north
* important consequences of reductions like water problems in walkerton

2. Download of responsibilities to other levels

* federal water management cut by 35%
* privatizing environmental services
* lower levels of governments now in charge (municipalities) - walkerton

3. little interest in consultative processes

* when theres consultations it snot meant to really listen to people, its usually done to give off impression that they're listening to people but they do whatever they want
* stakeholders and jurisdictions - their concerns aren't to listen to people

4. backing away from commitments to environmental issues

* emphasis on economic growth
* northern gateway

how do we solve a long term environmental issue

Vision of a solution

* realistic, credible and attractive future for a region or a group
* during development around a problem, questions to answer:
  + what is likely to happen?
  + what ought to happen?
  + what can happen?
  + people in charge of implementing it will know what everyone wants

vision 2020

an overview - 1992 (took pic)

ethics and values

* set of moral principles and values that: guides the actions or decisions of an individual or groups
* ecocentric perspective
  + favour application of low impact technology, advocate behaviour that promotes ecological morals and values
  + oppose bigness and impersonality in all forms
* low impact technology
* technocentric perspective
  + humans will learn to manipulate nature to fit their needs

obama rejects keystone XL pipeline

environmental justice

* according to the united states E.P.A: fair treatment and meaningful involvement of all people
* when addressing negative environmental problems, this means: no group of people should bear a greater share of the consequences
* regardless of: race, colour, national origin or income

basel convention

* signed in 1989, in switzerland , 53 countries have ratified it thus far
* extends the principle of environmental justice to international trade of: hazardous materials
* Trade forbidden under export and import of hazardous waste and hazardous recyclable material regulations, 2016
* ontario electronic stewardship : more than 100 000 tonnes collected

conclusion at the end of the ppt

ecocentric vs technocentric

diff between basic values and the way you live your life?

why is it difficult for policy makers to have a long term view?

**Lecture 6:** *Planning and Management Process*

**Lecture 7:** *Climate Change*

**Lecture 8:** *Ocean and Fisheries*

**Lecture 9:** *Water*

**Lecture 10:** *Impacts of Agriculture*

**Lecture 11:** *Agriculture*

**Lecture 12:** *Forests*

**Lecture 13:** *Minerals and Energy*

**Lecture 14:** *Energy*

**Lecture 15:** *Cities and Sustainability*

**Lecture 16:** *Urban Environmental Management*

**Lecture 17:** *Biodiversity and Protection Areas*

1. the biodiversity crisis

* more species are becoming endangered than what is natural
* parks do not equal and do not provide adequate protection
* blanding’s turtle (get crushed by cars)
* Impacts from modern society cannot be excluded
* predation: 100%
* normal: 62 to 64% loss
* extinction: a natural process
* occurs at certain rates over time

2. valuing biodiversity: economic values

* world’s plants never tested for human food potential: 99.8%
* of top 150 prescribed drugs in the US: 56% have ingredients from wild species
* tropical plants: 90% of worlds food supply
* pollination of plants required for: 30% of all food produced
* $1.2 billon/year
* fenitrothion use in 1970s

3. Habitat Change

* more than 70% of prairie wetlands drained
* remaining ones affected by farming
* 33% decline since 1960s

more habitat change = more risk to biodiversity

this is what the comparison of the extent of habitat change and risk of habitat change reveals

Chemical changes

* for freshwater species: pollution is 2nd most important cause of danger
* raptors: indicator species

bald eagle, peregrine falcon

4. Response to Loss of Biodiversity

* CITES: convention on international trade in endangered species of wild fauna and flora
* orchids
* CITES: instrumental in restricting trade in certain endangered wildlife species
* weak support of canada
* failure to pay dues
* ivory
* 1992 CBD: convention on biological diversity
* world summit on sustainable development, in rio de janeiro
* canadian biodiversity strategy (1995)

I dont have the points/missing blanks for #5 - lack of progress in canada

The species at risk act (SARA)

* passed in 2002; mandates COSEWIC: Committee on the status of endangered wildlife in canada
* pubic lands: mostly provinces
* federal responsibility , provincial responsibility , lack of coordination

COSEWIC

* determines the status of rare species
* if listed: 1st step in process in protection of proposed species at risk under SARA
* does not guarantee its protection
* if less than 1000 breeding pairsL species should be listed as threatened

SARA and politics

* listing process is impacted by political decisions
* atlantic cod, less than 1% left
* nunavut opposed
* in 2006 11% of species proposed for listing under SARA based on biological grounds - rejected on other grounds

**Lecture 18:** *Environmental Change and Challenges*

***MODULES:***

**Module 1:** *Environment and Resources*

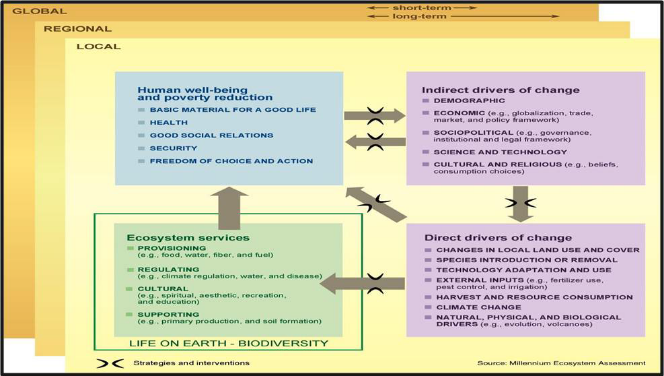
ENVIRONMENTAL AND RESOURCES:

The Millennium Ecosystem Assessment:

* It was carried out b/w 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being.
* It involves 96 countries

The Millennium Ecosystem Assessment Findings:

* It concluded that many of the changes are non-linear and once they start, the processes of degradation will increase rapidly.
* 4.3 people are born every second worldwide, 80 million per year which increases global energy consumption.



Economic Growth and Population occurs in 4 Main Phases:

1. High equilibrium marked by high birth and death rates.
2. High expanding marked by a high birth rate, and a low death rate.
3. Low expanding marked by a falling birth rate, and high death rate.
4. Low equilibrium marked by low, equal birth and death rates. This is the equilibrium commonly observed in development countries.

The Millennium Development Goals:

* These goals were adopted by the United Nations, in 2000.



* 70% of water use worldwide is for agriculture
* 5 to 25% of global freshwater use exceeds long-term accessible supplies
* There are 3-6 times as much water in reservoirs as in natural rivers

The Environment includes:

* Atmosphere
* Hydrosphere
* Cryosphere
* Lithosphere
* Biosphere

Anthropocentric view:

* Resources are valued only with respect to human utility. A resources doesn’t become a resource until it is useful for human needs
* Ex: coal and copper were not resources until humans understood how to use them

Biocentric (Ecocentric) View:

* Resources exist independently from human desires. They have value in their own right. Contributes to earth. Non-living components are part of the Ecocentric view
* Ex: Grizzly Bears have value regardless of their value to humans

Disciplinary Approach:

* Organized around concepts of a given discipline
* FALLBACKS: limits our understanding of complex systems

Multi-disciplinary Approach:

* Synthesis occurs after individual studies have been complete. Specialists examine an issue from each of their disciplinary perspectives
* FALLBACKS: lack of connecting research

Cross-disciplinary Approach:

* Researchers actively use knowledge from another discipline
* FALLBACKS: could lead to misunderstanding, over look material if unfamiliar

Interdisciplinary Approach:

* Specialists from separate areas actively working together from the beginning
* FALLBACKS: takes more time and money, requires trust

Transdisciplinary Approach:

* The subject is not the domain of a particular discipline
* FALLBACKS: could lead to confusion, overload of information

Science-based Environmental Management Guidelines:

* Focus the science on key issues and communicate it in policy form
  + Are we asking the right questions
* Use scientific information to clarify issue, identify potential management options and estimate consequences of these actions
* Clearly and simply communicate scientific findings
* Evaluate whether or not the final decision is consistent with scientific information
* Appear un-biased

Sustainable Development:

* Is development that meets the needs of the present without compromising the ability of future generations to meet their own needs
* It has 3 strategic aspects:
  + It presents a vision regarding the nature of future societies
  + It emphasizes a system of governance and management characterized by openness, transparency, decentralization, and accessibility
  + It seeks to ensure that **economic, environmental, and social** aspects are considered together, and that trade-offs are visible and transparent to those affected

Sustainable livelihoods :

makes sure that humans can meet their basic needs and other needs related to dignity and security through meaningful work

Resource management that enhances resilience of social-ecological systems is more sustainable than the traditional approach, which focuses on optimizing output of goods and services from a natural resource system.

One of the goals of science is to provide understanding of complex problems, and one way of doing this is to use of indicators.

The Living Plant Index: created by the WWF tracks 1,313 vertebrate species.

**Module 2:** *Ecosystems and Biodiversity*

Unit 1

· Energy and its different forms

o Sun is most important source of energy for the earth

§ Energy reaching earth is only 1/50,000,000 of the sun’s output

o Energy is the capacity to do work

o Can be found as heat, in chemical bonds, as electricity, or as mechanical energy

· Laws of thermodynamics

o 1st law: law of conservation of energy

§ Energy cannot be created or destroyed (just changed)

· Total amount of energy in the earth is always constant

· When an organism dies, energy is absorbed into other parts of the earth

o 2nd law: law of entropy (energy degradation)

§ When energy is transformed, some is lost

· Can be lost as low-quality energy (heat, sound, etc.)

· Low-quality energy

o Diffused and dispersed at high temperatures

o Majority of energy in ecosphere

o Ex. Ocean tides

· High-quality energy

o Easy to use/harness

o Provides intense energy

o Ex. Coal, hot fire

§ Energy waste occurs when high-quality energy is used when only low-quality energy is needed

· Occurs in developed countries all the time

· Ex. Fossil fuels burning results in only 10% of the energy being converted into mechanical energy (the rest is released as heat)

Unit 2

· Different types of organisms involved

o Autotrophs (producers)

§ Organisms that can capture energy and manufacture matter

§ Phototrophs (plants)

· Absorb energy from the sun

· Photo = light

· Photosynthesis absorbs CO2 and releases oxygen

§ Chemotrophs (bacteria)

· Create energy from chemicals available in environment

o Heterotrophs (consumers)

§ Organisms that obtain their energy by eating other organisms

§ Hetero = different

· Herbivores/carnivores/omnivores (common sense)

· Food webs/chains

o Most complex food webs exist in most favourable conditions for life

o Debate whether webs are controlled by the predators (top down control) or by prey (bottom up control)

o Decomposer food chains and based on dead organic material

§ Are just as important as grazer food chains

§ Necessary to break down dead organic material

· Biomass pyramid

o 2nd law of thermodynamics shows how energy travels from trophic level to trophic level

§ 90% of energy is lost between trophic levels

§ Due to not all biomass being converted into food, not all food is ingested, not all ingested food is digested

o Longer the food chain, more energy lost and less energy gained from eating the top of the food chain

· Productivity

o Most productive ecosystems are wetlands and tropical rainforests

o Least productive ecosystems are open ocean, arctic and deserts

o *Humans use 40% of all land productivity for our own use*

Unit 3

· Ecological succession

o Gradual replacement of one species by another as ecological conditions change

o Can be cyclic and vary drastically over time

o Primary succession

§ Colonization of previously unvegetated surface, where little/no soil exists

§ Ex. Glacier retreats, landslide wipes out an area

· Primary colonizers are firsts species to occupy area

o Must be tough and resistant to limited resources

o Ex. Lichens

· Seral stage

o Stages of succession

o Lichens moss à small shrubs à healthy mix à trees

o Secondary succession

§ Sequential development of biotic communities on previously vegetated surfaces with soil cover

· Ex. Abandoned farm lands, forest after fire

§ Similar processes can occur in aquatic ecosystems

· Disturbance

o Event that alters ecosystem structure/function

o Can be a healthy part of ecosystem development because ecosystems are dynamic

§ Ex. Fire, flooding, etc.

§ Fire has been used in forest management, facilitate agriculture, improve grass growth

· Favours specific species

· Immature vs mature ecosystems

o Diversity won’t increase indefinitely

o Diversity will be max at mid disturbance levels

§ @ low disturbance, not all species will thrive as weed/pests may take over

§ @ high disturbance, not all species will be able to survive

o Humans influence helps maintain systems even at immature stage

§ Ex. Agriculture

§ Improves production, but reduces biodiversity

· Equilibrium

o Climax community is when seral stages reaches equilibrium with environment

§ May not be reached due to fires, insect infestations, flooding, ice storms

§ Should be viewed as always evolving

§ Climatic climax is when climate determines community composition

· Ex. Sand dunes

§ Edaphic climax is when soil conditions determined community composition

· Ex. Mountains with unique rock composition

Unit 4

· Ecozones

o Groups of ecosystems with similar dominant vegetation/animal communities

o Main factors in Canada are water availability, temperature

· Biomes

o Many ecozones combined based on dominant vegetation and animal adaptations

· Abiotic components

o Light, temperature, wind, water, soil characteristics

o Soils

§ Composed of inorganic materials, decaying organic materials, water and air

§ Soil is layered based on way different parts of the soil form

o Limiting factors determine whether an organism can survive

§ Dominant limiting factor is the weakest factor for a specific species survival in the specific ecosystem

§ Optimal conditions are a range, with too much or too little of a factor can cause stress in a species or even make it uninhabitable

§ Species such as cockroaches and rats have a huge optimal range

· Feedback loops

o Positive feedback loop are self-amplifying cycles (exacerbation/increase)

§ Ex. Global temperature increase à more ice coverage melting à less cooling effects from ice coverage à global temperature increase

o Negative feedback loops are self-sustaining cycles (moderation)

§ Ex. Phytoplankton levels increase with global temperature increase à phytoplankton produces sulfide à sulfide increases cloud coverage à reduces sun rays hitting the earth à mediates temperature increase

Unit 5

· Carrying capacity

o Population that can be sustained in an ecosystem

o Based on biotic and abiotic components

o Biotic potential

§ Max rate at which a species may increase with no environmental resistance

§ Once biotic potential is met, population crashed below capacity

o Density dependent species (s-shaped growth curve)

o Density independent species (J-shaped growth curve)

· R-strategists

o Produce large # of young, but little parenting

o Ex. Insects, rodents, fish

o Usually small and short-lived

o Quantity over quality

· K-strategists

o Produce few offspring, but invest a lot of time/care

o Ex. Large mammals (including humans)

o Usually live longer and are larger

o Most endangered species are k-strategists

· Evolution and natural selection (common sense)

· Speciation (creation of species)

o When so much evolution has happened that they can’t interbreed with original species anymore

o Happens due to geographical isolation or populations, or adaptations of only part of a population

· Coevolution

o Changes in one species cause changes in another

o Ex. Prey becoming better at avoiding a predator may force a predator to become better at hunting it

· Extinction

o 99% of species that have every lived on earth are now extinct

o Until recently (due to humans) speciation rates > extinction rates

**Module 1:** *Environment and Resources*

unit 1: Change in natural systems - timescales involved, types of changes, examples

* humans have constantly experienced changes
* example - ice age period that started in medieval times and in 19th century where people in europe experienced a return of cold glacial conditions.
* **variation is constant in natural systems**
* example - (negotiations?variations? i cant understand the word hes saying) between cold glacial periods and warm interglacial periods over the past several hundreds of thousands of years
* changes in natural systems are more abrupt and are happening faster now
* earths climate is changing and so is our environment. example - global warming which is the trend of globally increasing average surface temperature since the middle of the 19th century
* strong evidence that human activities are a key driving force behind environmental change. these changes are due in part with how humans are interacting with natural systems and their activities. example - atmospheric pollution and deforestation

unit 2: The millennium ecosystem assessment, its findings and the development goals

* the **millennium ecosystem assessment (MEA)** was called for by the united nations secretary general kofianan 2000.
* carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well being and to establish the scientific basis for actions needed to enhance the conversation and sustainable use of ecosystems and their contributions to human well being
* the MEA involved the work of more than 1300 experts from 95 countries.
* their findings provide scientific appraisal of the condition and trends in the worlds ecosystems and options to restore, conserve or enhance the sustainable use of ecosystems
* experts concluded that many of the changes are non linear and once they start the processes of the gradation will increase rapidly
* a key variable that affects our impact on the planetary life support system are the amount of people being supported (over 7 billion as of late 2011)
* global energy consumption has increased as population has increased, as well as pollution.
* 4.3 ppl born every second worldwide, 80 mill/year
* **UN predicts over 10 billion people by 2100**
* reproductive choices have large implications. They have the potential to lead to drastic increase in world population. these choices are reflected by the relative distribution of the age cohorts within population

unit 3 - the difference perspectives on what constitutes a resource

**what is the environment?**

environment includes atmosphere, hydrosphere, lithosphere and biosphere, in which humans, other living species and non living components exist

**what is a resource?**

resources are specific components of the env. such as forests, oceans, rivers and lakes, minerals and petroleum and wildlife

there are different perspectives as to what constitutes as a resource:

**anthropocentric view** - value is defined relative to human interest, wants and needs. elements in the environment such as minerals or animals do not become resources until they have value to humans. example - coal and copper were not considered resources until humans understood how they could be used and had the technology to access and utilize them.

**biocentric (ecocentric) view** - resources exist independently from human desires. they have ecological and existent value in their own right. In this view they don’t necessarily have an immediate value to humans, instead their values reside in that they contribute to the earth as a global ecosystem. example - grizzly bears have intrinsic value regardless of their immediate value to people.

The difference bw the biocentric and the ecocentric views is that non living components are part of an ecocentric perspective, not just living beings. the physical integrity of ecosystems is also important according to this view - for example water and air quality

unit 4 - the different approaches to understanding the environment, and our relation to it

* the world is not divided into compartments however we have yet to have a holistic view of the environment. it is still by designated by knowledge, constrained within different disciplines. This is reflected by different approaches to our understanding of the environment
* **disciplinary approach** - is organized around the concepts, theories, methods and assumptions associated with one academic discipline. this approach may limit our understanding of complex systems. this approach breaks down environmental problems in different parts that may be easier to grasp. example - we can consider a problem from the perspective of the field of bio or from the perspective of environmental chemistry. However, this provides a reductionist view of the environment
* **multi disciplinary approach** - specialists examine an issue from each of their disciplinary perspectives. Their findings and insights are synthesized which increases understanding. a drawback is that combining results after the research has been conducted may result in a lack of connecting research
* **cross disciplinary approach** - disciplinary specialist borrows concepts, theories and methods from other disciplines to enhance their perspectives. example - a soil specialist using concepts and methods from plant signs. can increase understanding of a problem but can also lead to misunderstanding. a researcher can also overlook material which they are unfamiliar with
* **interdisciplinary approach** - various specialists work together from the beginning of a project leading to synthesis and integration of understanding. it is time consuming and requires time, patience and openness. this approach incorporates the benefits from all disciplines from the start therefore connective research needs can be identified. drawback is that it takes extra money and time or communication
* **transdisciplinary approach** - extends previous perspective by seeking holistic understanding that transcends disciplinary boundaries. not viewing them in the context of any one discipline and weighing each area equally. this can enhance understanding or lead to confusion and may lead to info overload. example - sustainable development which brings together concepts and methods from the field of science, engineering, economics and includes equally important research from environmental, social and other areas of research
* all relevant info must always be revealed

unit 5 - sustainable development and livelihoods

* **sustainable development** - is development that meets the needs of the present without compromising the ability of future generations to meet their own needs
* 3 strategic aspects:
  + 1. presents vision regarding the nature of future societies
  + 2. emphasizes a system of governance and management characterized by openness, transparency, decentralization and accessibility
  + 3. It seeks to ensure that **economic, environmental, and social** aspects are considered together, and that trade-offs are visible and transparent to those affected
* some believe that it provides a compelling vision for the 21st century that acknowledges longer term development, implications and the need to balance social, economic and environment considerations. others believe it is a vague term
* **sustainable livelihoods** - emphasizes the conditions necessary to ensure that basic human needs are satisfied . human centred approach to a broad environmental management. Ways for local people to meet basic needs as well as other needs related to dignity and security. At same time it aims to minimize environment degradation, rehabilitate damaged environments and address concerns about social justice.
* concept may be too anthropocentric - however addressing poverty is a priority that is important
* **Resilience** - ability of a system to absorb disturbance while still retaining basic structure and function.

**Module 2:** *Ecosystems and Biodiversity*

Unit 1 - high/low quality energy

note - energy is the capacity to do work

* Laws of thermodynamics
  + 1st law: law of conservation of energy: Energy cannot be created or destroyed (just changed). Total amount of energy in the earth is always constant. When an organism dies, energy is absorbed into other parts of the earth
  + 2nd law: law of entropy (energy degradation): when energy is transformed, some is lost. Can be lost as low-quality energy (heat, sound, etc.)

**Low-quality energy**

- Diffused and dispersed at high temperatures

- Majority of energy in ecosphere

example - Ocean tides

**High-quality energy**

- Easy to use/harness

- Provides intense energy

example - Coal, hot fire

* energy waste occurs when high-quality energy is used when only low-quality energy is needed
* occurs in developed countries often. example - fossil fuels burning results in only 10% of the energy being converted into mechanical energy (rest released as heat)

Unit 2 - differences in productivity between ecosystems

Autotrophs - organisms that can capture energy and manufacture matter

Photosynthesis - conversion of radiant energy into high potential biomass. efficiency of conversion: 1 to 3%

Heterotrophs - organisms that obtain their energy by eating other organisms

* rate at which energy is changed into biomass: kilocalories per square metre per year
* **gross primary productivity** - overall rate of biomass production
* **cellular respiration** - the metabolic cost which must be subtracted from the gross primary productivity to reveal the **net primary productivity** which is the amount of E available to heterotrophs
* forestry as an industry aims to target the crop optimum - where the max net primary productivity is attained
* most productive ecosystems are wetlands and tropical rainforests
* least productive ecosystems are open ocean, arctic and deserts
* humans use 40% of all terrestrial net primary productivity for our own use
* measurements can also be made of net community productivity including heterotrophic and autotrophic respiration. over time, natural systems mature
* auxiliary energy flows allow some ecosystems to be very productive

Unit 3 - ecological succession

* ecosystems and communities change over time (rapid or slow)
* example - how species are expected to respond to climate change
* ecological succession - gradual replacement of one species by another as ecological conditions change over time
* can be cyclic and vary drastically over time
* **primary succession** 
  + colonization of a previously unvegetated surface, where little/no soil exists
  + example - when glacier retreats, or when landslide wipes out an area and removes all traces of previous ecosystem
  + primary colonizers are the first species to occupy the area. they must be able to withstand harsh conditions and be resistant to variation in temp, water available or nutrient supply. example - lichens, moss - biomass traps water and nutrient, allows other species to colonize
  + next stage in the successional advance is invasion by plants like grasses and wheat species. Seeds that line wheat are considered part of the soil seed bank
  + next stage is hardy shrubs. final stage dominated by trees
  + each stage is a **seral stage**
  + **climax community** - believed to be a stable and well defined stage. believed to be when equilibrium with the environment is established however it has been found that this is rare bc of disturbances, like insect infestation, fires, floods
  + communities do not always reach a stable climax community and a climax should be seen as constantly evolving.
  + **climatic climax -** vegetation strongly influenced by climate example sand dunes which are governed by temperature and water availably
  + **edaphic climax** - is when the soil conditions determines community composition example - table mountain in newfoundland. only rare species of plants due to unique rocks under it made of high metal content
  + **disturbance** - event that alters ecosystem, structure and function. most are natural and integral parts of healthy ecosystem function
* **secondary succession** 
  + sequential development of bounty communities on previously vegetated surfaces with soil cover example - abandoned farm lands, forests after fire
  + similar processes can occur in aquatic ecosystems

Unit 4 - keystone species and hyper abundance

* removal of certain species from food webs can disturb the ecosystem
* **keystone species** - species that have a strong influence on their whole community example - beaver which modifies the hydrological regime at given locations
* it is very significant when a keystone species is removed from an area or extirpated by human activity
* a cascade of effects typically follows
* **hyper abundance -** native species can be pests when their population increases to undesirable numbers. where natural habitats have been disturbed or when predatory species are removed, species calls are used to control these population explosions
* **feedback loops** are important to maintain stability one ecosystems where info is fed back into a system as a result of change. initiates change

Unit 5 - r and k strategists

* **biotic potential** - capacity of species to increase in number. the maximum rate at which a species may increase if there is no environmental resistance
* **r strategists** - produce large numbers of young early in life and over a short time period but invest little parenting energy in their upbringing. example - algae, fish, insects, rodents, annual plants. these species are usually small and short lived. they are opportunists. they tend to dominate the early seral stages of the susexional process. **focus on quantity of offspring.**
* **k strategists -** focus on quality. produce few offspring but devote time and effort to ensure the offspring reach maturity. tend to live longer and are larger. example - larger mammals including humans. Many endangered species are k strategists

**Module 3:** *Ecosystems and Matter Cycling*

Unit 1 - What are biogeochemical cycles, how they work, their different types, different types of nutrients

* ecosystems vary substantially in terms of the speed of cycling and the relative proportion of nutrients within each compartment example - comparing the temperate forest and the tropical forest soils.
* speed of cycling may also change depending on the season and type of nutrients. example - may take 300 years for an atom of carbon to pass through the whole carbon cycle
* **resistance/resonance (idk which one he said) time** - the length of time that something stays in one compartment. example - CO2 stays in atmosphere an avg of 5-7 years
* **detritus food chains** - main means by which nutrients in the biotic component of the ecosphere are recycled to the abiotic component for future reuse. earths major mediator in nutrient recycling. include fungi, slugs, snails, beatles, ants, termites, earthworms, heterotrophic bacteria. each plays its own role in nutrient recycling
* under natural conditions, recycling rates between components achieve a balance over time in which inputs and outputs are equal. human activities speed up the transfer bw the components of cycles. many pollution problems result from human induced accumulation in one or more components of a cycle that is too great from natural processes to dissipate
* cycles can be classified according to the main source of their matter
* gaseous cycles - most of their matter in the atmosphere example - nitrogen cycle
* sedimentary cycles - most of their matter is in the lithosphere example - phosphorus and sulfur. elements in this cycle tend to cycle more slowly than elements in the gaseous cycle.
* there are elements that may be locked in the geological formations for millions of years
* these cycles mobilize materials from the lithosphere to the hydrosphere back to the lithosphere. some involve the gaseous phase and some do not. such cycles rely on geological uplift over long periods to complete the cycle.
* while carbon is most abundant in rocks and sediments on earth, the carbon that is most relevant to biological activity is in the atmosphere

Unit 2 - The importance of phosphorus; the major features of its biogeochemical cycle, and the associated environmental impact

* phosphorus is a macronutrient incorporated into many organic molecules. it is essential for metabolic energy use. it is relatively rare on the earths surface in relation to demand
* its critical that phosphorus cycles efficiently between compartments. its not well replenished by watering or soil availability. the amount retained by biomass is critical
* P is often the dominant limiting factor in freshwater aquatic systems and for plant growth in terrestrial soil, hence the need for use of fertilizers heavy in P
* Nitrogen and carbon cycles in the ocean which are key in the response to global warming are controlled by P so P will be a main determinant of global futures
* availability of P is influenced by soil acidity. it gets bound into insoluble compounds under very A or very B conditions therefore acid precipitation limits P availability.
* rocks in the earths crust, animal waste and decomposition are large source of P to soil
* bacteria mineralize P into soil back into inorganic phosphate making it available to plants.
* P in soil is taken by plants or removed by water transport.
* transport of P and other nutrients by streams into lakes and oceans increases the productivity of coastal ecosystems and enter the arsenic food chain via uptake by phytoplankton
* guano are marine bird droppers which return P from marine food chain back to land. this is a main source of phosphorus for use as fertilizers
* humans interfere in the P cycle by mining P rich rocks for fertilizers and detergents leading to excess P in runoff, by removing biomass leading to erosion and P in runoff, by concentrating organisms that produce P in waste such as cows, pigs which leads to waste and P in runoff and removing P from arsenic systems through fishing leading to more inputs of P to freshwater and ultimately to marine systems again. results in eutrophication from excessive P accumulation in freshwater ecosystems

Unit 3 - The importance of nitrogen, the major features of its biogeochemical cycles

* required by all organisms for life
* essential component of chlorophyll, proteins and amino acids
* 78% of atmosphere - contains other forms like ammona, nitrogen dioxide, nitrous oxide, nitric acid
* most important nitrogen cycling occurs in the atmosphere lithosphere interphus (true biological activity)
* atmosphere lithosphere interphus - most important N cycling is ongoing through biological activity
* the main way in which the atmospheric reservoir is linked to the biotic components of the food chain is through N fixation and denitrification - both mediated through microbial activity
* important processes: mineralization, nitrification and denitrification
* N often limiting factor in terrestrial soils
* nitrogen fixation occurs as bacteria transform atmospheric N into various forms that are available to plants like nitrate and ammonium
* the most important N fixers are bacteria of the **rhinobium** that grow on the root nodules of plants in the pea and legume family - example of mutualism
* chemotrophic bacteria fix nitrogen gas into ammonia and ammonium. other bacteria and algae that fix N are not attached to specific plants. these free living N fixers are important in arctic and ocean
* 5% of N occurs in the atmosphere via lightning
* N is tightly circulated in most ecosystems between dead and living biomass. most physical N in soil as nitrates and ammonium salts comes from the breakdown of existing biomass by decomposer food chains
* **mineralization** - process by which decomposing biomass (Ex dead plants ) is converted back to ammonia and ammonium salts by bacterial action and returned to soil
* nitrification - chemotrophic bacterium convert ammonia and ammonium into nitrates and nitrites
* **denitrification** - anaerobic bacterium convert nitrates into N gas, returning it to the atmosphere
* nitrates are easily soluble in water. they are easily lost to the ecosystem via surface runoff. ammonia tends to adhere to soil particles and is also susceptible to loss by soil erosion
* like phosphorus, N is often a limiting factor for growth. when excessive concentrations occur in water, they are a major contributor to process of eutrophication
* however unlike P, N is not immobilized in deep ocean sediments but has an effective feedback mechanism to the atmosphere from the ocean through microbial denitrification
* humans interfere in N cycle through chemical fixation to supply nitrates and ammonium as fertilizer, leading to runoff of excess fertilizer and contributing to eutrophication and denitrification which contributes to climate change. also by the removal of nitrate and ammonium ions from agricultural soils through harvesting of N rich crops. finally, by high temperature combustion which produces nitrate oxides which combines with oxygen to produce nitrogen dioxide which reacts with water vapeur to form nitric acid, a main component of acid deposition

Unit 4 - the importance of carbon, the major features of its biogeochemical cycle and the associated environmental impacts

* C02 makes up 0.03 % of atmospheric gases but is a main reservoir for the carbon that is a building block for all necessary carbs, fatty acids and proteins that make up living organisms
* plants take up co2 directly from the atmosphere through photosynthesis while emitting oxygen
* carbon is incorporated in biomass and is passed along the food chain
* respiration by organisms transform some carbon in biomass back into co2 which enters the atmosphere
* cellar respiration by decomposers helps to return carbon from dead organisms into the atmosphere as CO2 and in anaerobic conditions as methane
* the cycling of C and the flow of energy through the food chains are closely related
* C can be stored in the lithosphere for extended periods of time as organisms become buried before they decompose - particularly true under relatively inefficient anaerobic decay conditions such as in pete bugs
* over millions of years past forest, marine and freshwater ecosystems have been transformed into fossil fuels through heat and compression
* c02 can be dissolved in shallow ocean waters for up to 6 years and deeper for up to 350 years
* oceans capacity to store co2 may be decreasing under increased atmospheric co2
* large amounts of C are stored more much longer periods in the ocean through the death of marine organisms with calcium carbonate shells which eventually form rocks
* humans interfere by - replacing natural ecosystems, with land uses (urban and agricultural systems that have reduced capacity to uptake and store c)
* Human activity has mobilized large amounts of fossil fuels from lithospheric component of the cycle to the atmospheric component
* we release the equiv. of 1 million years of photosynthetic activity annually. atmospheric co2 now exceeds 390 ppm - more than 90 ppm above the max values of the past 740 000 years

Unit 5 - the importance of the hydrological cycle, its major features and the associated environmental impacts

* humans interfere in the hydrological cycle by:
  + the storage and redistribution of runoff to offset water supplies for domestic, agricultural and industrial uses
  + the building of storage structures to control floods
  + the drainage of wetlands
  + the pumping of groundwater
  + land use changes such as deforestation, urbanization and agriculture that effects runoff and evapotranspiration patterns
  + climatic change caused by interference with other biological cycles

**Module 4:** *Environmental Planning and Management*

Unit 1 - social learning; single loop learning; double loops learning

**Social learning -** learning is applied not only to individuals but also communities and organizations. resource and environmental management processes should be designed so that both individuals and organizations are able to learn from their experience and become more knowledgeable and effective in the future

**Single loop learning -** aims to ensure a match between intent and outcome. this leads in the change of two conditions in the result of monitoring. what is the right way to get something done? improving the system as it exists. example - thermostat receives info and takes corrective action to ensure a consistent outcome with the intent

**double loop learning -** addresses a condition when there is a mismatch between intent and outcome. has underlying assumptions, values and beliefs. out of the box thinking example - why do we want to regulate temperature in the first place?

Unit 2 - ingenuity gap

* Refers to the mismatch between the supply of ideas needed to fix environmental problems and the availability of such ideas

Unit 3 - what is the ecosystem approach and what are its characteristics

* ecosystems - consist of communities of biotic and abiotic elements interacting with e/o. their management requires assistance or holistic perspective
* people have been aware of the value of an ecosystem approach for the planning and management if issues for a while and have been using it for decades
* the ecosystem approach has a set of core characteristics:
  + systems, concepts and analysis
  + ethical perspectives
  + stakeholder in public participation
  + bioregional place placed focus
  + efforts to identify and develop common goals
  + gaining a systematic understanding of the ecosystem in interest
* the ecosystem approach has been developed to address common problems in the management of environmental issues:
  + viewing people and their activities as separate from nature
  + the fragmentation of knowledge or disciplines, ecosystems, jurisdictions and management responsibilities
  + emphasizes single resource uses or economic sectors
  + ignoring conflicts over possible alternative uses
* other problems that it aims to solve:
  + not recognizing the many ways in which ecological and socioeconomic systems are interconnected
  + ignoring the propensity of biophysical and socioeconomic systems to change sometimes rapidly and unexpectedly
  + being reactive and attempting to eliminate uncertainty by controlling complex dynamic systems instead of anticipating change and problems and adapting to them
* this approach challenges dominant and techno centric perspective which is big in north america

**Module 5:** *Planning and Management Process*

Unit 1 - the rungs on the ladder of citizen participation

* during 1980s: dissatisfaction with the process, methods and products associated with many resource and environmental decisions began to rise
* out of this situation, came the idea that stakeholders had a right to participate in decisions
* this is illustrated on the rungs on the ladder of citizen participation
* **tokenism** - policy or practise of limited inclusion of members of a minority group, usually creating a false appearance of inclusive practises (intentionally or not)
* **stakeholders** - those who should be included bc of their direct interest including any public agency with prescribed management responsibilities, all interests significantly affected by the decision or all parties who may intervene in the decision making process to facilitate, block or delay it

Unit 2 - the issues around the communication of environmental science issues to the public

* it has been proposed in literature that scientific communication when it comes down to environmental issues has 3 main purposes:
  + to raise awareness
  + confer understanding
  + motivate action
* to overcome communication challenges, we must:
  + recognize that a range of target audiences exist such as scientists, planners, managers, elected decision makers and the general public
  + ensure that messages are created with regard to who the target audience will be and what their level of understanding is. much of the general public doesn't understand science or how it is conducted. example - polls of public opinion on global warming in usa
  + the general public doesn't understand concept of probability - risks, causation, association all mean the same thing in their mind

Unit 3 - precautionary principle

* since risks have to be estimated, calculations may be incorrect
* this principle was endorsed for this reason
* its a guideline stating that when there is a possibility of serious or irreversible environmental damage resulting from a course of action, lack of scientific certainty is not an acceptable reason for postponing a measure to prevent environmental degradation or for assuming that future damage can be rectified by some sort of technological fix

Unit 4 - public consultation, negotiation, mediation, arbitration

Public consultation - involves the concepts of partnership and delegated power

Negotiation (one of two main types of alternative dispute regulation) - when two or more parties involved in a dispute join in a voluntary, join exploration of issues. participates can withdraw at any time

Mediation (second of two main types of alternative dispute regulation)- a negotiation process guided by a facilitator (mediator). The mediator helps the parties overcome differences and reach agreement. they have no power to impose any outcome.

Arbitration - a third party is selected to listen to the views and interests of the parties in dispute. they are responsible for choosing a solution for the parties.

**Module 6:** *Climate Change*

Unit 1: what is climate change

* climate - composite of the variety of day to day weather conditions
* **climate change** - long term alteration in the climate of a specific location, region or a planet
* earth has gone through warm and cold periods
* global warming - changes in the average surface temperature

Unit 2: the different lines of evidence, of ongoing climate change

* solid scientific evidence supports the following points:
  + the world has been warming with an avg global temperature at the earths surface having increased by about 0.6 degrees celsius with an error range of plus or minus 0.2 degrees celsius since the late 19th century - the years since 1995 have been among the warmest since 1950
  + the increase in the average temperature in the northern hemisphere during the 20th century was the largest of any century in the past 1000 years
    - this can be traced in paleo climate indicators (past climate indicators)
    - based mostly from ice core, coral reef and tree rings
    - greenhouse gas concentrations have been rising for several decades
    - carbon dioxide and methane concentrations are higher now than at any point over the past 400 000 years. same for nitrous oxide
    - in many areas of the world, theres a reduction in permafrost and snow covers
    - glaciers have lost more mass than they have gained. this is also due to the increase in global temperature
    - moving glacier - vancouver island. 1931 vs 1981 - huge difference in size
    - good science - cross checking of data sources to ensure there is no limitations of data source or measurement error
* the findings related to temperature, GHG concentration, glaciers, snow cover, river and lake ice breakup, permafrost all indicate that climate change is occurring
* the uncertainty associated with global climate is encouraging scientists to explore many different ways of assessing past and future climates
* one approach - climate modelling
  + science of climate modelling has been more worked on due to more concern about climate change
  + all climate models consider some or all 5 components to predict future climates: radiation, dynamics, surface processes, chemistry and time step and resolutions
  + general circulation models (GCM) are most common - take 3D nature of earth to account. combine atmospheric, land and ocean surface models
  + the model provides a way to assess past and future climates
  + consider radiation and E provided to the system and the impacts of surface processes example - snow cover on climate as albedo as well as its chemistry for example carbon cycling
  + time and spacial scales are involved
  + possible to evaluate scenarios like the two fold carbon dioxide world - twice the preindustrial amount of carbon dioxide in the world - to happen by 20150 (Estimate)

**Module 7:** *Oceans and Fisheries*

**Module 8:** *Water*

**Module 9:** *Impacts of Agriculture*

**Module 10:** *Agriculture*

**Module 11:** *Forests*

**Module 12:**  *Minerals and Energy*

**Module 13:** *Energy*

**Module 14:** *Sustainable Cities*

**Module 15:** *Urban Environmental Management*