

Technology, Society and the Environment

Lecture 1= the Drivers of Change (Population, Economy, Social Values, Technology, Environment)

- POPULATION
- 2005 – 6.4 billion people on the planet
- By 2050 --- 8.9 to 10.3 billion on the planet
- Population increasing at a rate of ~ 73M/year
- During your life-time the global population has increased by 28%

- CITIES
- >95% of growth in developing countries
- In Canada 85% live in cities
- By 2050 65% will live in cities
- China planning to reverse 80% rural 20% urban with a generation of over 200 >1M cities to be built

- MONEY
- **Gross Domestic Product** = the total market value of all the goods and services produced within the borders of a nation during a specified period.
- **Gross World Product** = Measurement of the total income and output of all the countries added up.
- During your lifetime almost 70% increase in GDP
- International Trade expanding rapidly, 20% increase in GWP
- 2004 -- \$54.7 trillion, \$8.6 per capita..... 2050 -- >\$200 trillion
- Poor countries had there best times in the 60s and 70s at 3.3 % growth.

- CARS
- 2004 production of 44M cars vs. 8M in 1950
- Car Density in China equal to US in 1910-1920's
- Bad Things about Cars
- Oven the cities, plus heated pavement for cars
- Noise
- Acid Rain, Smog, Benzene, Sulphur, Road Salt

- AGRICULTURE
- Grain harvest exceeds 2 billion tons
- World meat production > 250M tons, > 40kg/per person
- By 2020 consumption will be 90kg/capita in industrialized nations
- Over 70% wild fish stocks in decline or depleted.

- MILLENIUM DEVELOPMENT GOALS FOR 2015
- Halve the number living in extreme poverty and hunger
- Universal Primary Education
- Reduce child mortality by two thirds
- Combat disease by doubling access to safe drinking water and sanitation

- SOCIAL CAPITAL INDICATORS
- **Social Capital** = the collective value of all social networks and the inclinations that arise from these networks to do things for each other
- **Cohesion** – Working together
- Including everyone
- Responsible and Informed
- **Transparency** = full, accurate, and timely disclosure of information
- **Corporate social responsibility** = company's obligation to be sensitive to the needs of everyone

- TECH TRENDS
- **Biomimicry** = imitation of a natural phenomenon's or environment's efficiency and survival mechanisms in manufacturing processes
- Efficiency, Conservation, and Conversion

- READING 1 = Economic clout (influence) grows
- "Group of 21" - a collection of countries from the developing world led by Brazil that includes South Africa, India and China
- Brazil, South Africa and India - got together to fight pharmaceutical companies' high prices for life-saving medicines
- After protests by those three countries, the World Trade Organization granted poor nations the right to make and import cheap copycat medicines for "national emergencies."
- Trade between poorer countries now makes up only 10 percent of world trade but it is growing rapidly
- 40 percent of exports from developing countries go to their peers, and trade between these countries is rising 11 percent a year
- **BRICs** - Brazil, Russia, India and China
- The BRICs countries' combined GDP adds up to about one-sixth of that of the G6 economies, by 2025 it should be 1/2
- **G6 countries** - the United States, Japan, Germany, France, Italy and Britain
- 2050 biggest economies will be (in order) China, USA, India, Japan, Brazil, Russia

- MEGA CITY LESSONS
- The Zabbaleen innovation, for example, arose in large part because of a waste management emergency in Cairo,
- Four ingredients for successful implementation
- Sustainable innovations depend on direct community participation. (commitment)
- Most innovations are driven by a charismatic leader who is tenaciously dedicated to implementing the new idea.
- The most powerful innovations are those which span several policy areas and types of innovations
- Gender awareness was needed at all levels. (important role of women)
- Obstacles → inadequate funds, land, people, supplies....internal community conflict.... Government resistance..... Tech problems

Lecture 2 = State of the Environment

- PROVISIONING SERVICES = stock of necessary supplies
- Food, Water, Fiber, Genetic, Biochemical's
- Water as an example...
- Forests and mountain ecosystems provide water for 4 billion people
- Water supply unchanged but demand has doubled between 1960 and 2000

- REGULATING SERVICES = attempts to control the environment
- Air quality, water, erosion, disease, natural disasters, waste treatment
- Natural Hazard as an example.....
- People live in dangerous areas, coastal, flood lines, drought, Wildfires increasing
- Cost and impact increasing - > 600,000 fatalities, \$1.3 Trillion since 1980 from weather alone
- Ecosystems degradation – wet lands, mountain forests – reduces natural systems and protection

- CULTURAL SERVICES
- Spiritual and Religious, Aesthetic, Recreation, Eco-Tourism (Tourism involving travel to areas of natural or ecological interest)
- Eco-Tourism as an example.....
- Accounts for >20% international travel
- Fragile environments have limited capacity and low recovery rate

- ECOSYSTEM PROCESSES
- Soil Formation
- Primary Production : production of biological organic compounds from inorganic materials through photosynthesis or chemosynthesis
- Water Cycling = Evaporation, Precipitation, Runoff
- Carbon cycling = Breath in O₂ breath out CO₂, plants do opposite
- Nutrient cycling as example ...
- Food production increased but freshwater services reduced
- Large P reservoir on agricultural lands subject to erosion

- FINDINGS
- More environmental change in last 50 years than any period in human history
- Changes have resulted in improved well being but at growing environmental cost
- Human activity exceeds capacity of nature
- With no change we will need 4 planets to meet peoples needs.

- HURRICAN KATRINA
- Category 5 hurricane
- Deadliest hurricane to hit the United States since Camille in 1969
- Very likely will be the most destructive and costly of all time.
- 2005 will see double the number of tropical storms (21) and hurricanes (11) compared to the average
- **Atlantic Multidecadal Mode** = the result of a change in ocean and atmospheric conditions
- The Hiroshima Bomb “Little Boy” had little destructive power compared to a hurricane

- Rains 2.5 metres of water in a single day bodies of water rise by as much as nine metres and pull the sea inland by 16 kilometres winds up to 300 kilometres per hour
- Energy released daily in the form of rain and wind is the equivalent of about 13,000 megatons
- Hurricanes are fed by water vapour from tropical surface waters and making the air hotter and more humid. (100 billion litres of liquid water per hour)
- MILLENIUM ECOSYSTEM ASSESMENT
- Dust storms in the Sahara has also been implicated in respiratory problems as far away as North America and has affected coral reefs in the Caribbean
- Dust in the atmosphere adversely impacts cloud formation and rainfall patterns, increasing desertification
- Infant mortality rate is double in the dry lands of developing countries compared to the non-dry.
- Dry lands occupy more than 40% of the world's land area and are home to over two billion people
- 2,000 cubic metres per capita per year considered a minimum for meeting human needs, 1300 in dry
- The greatest vulnerability is ascribed to sub-Saharan and Central Asian dry lands

Lecture 3 = Environmental Issues in Canada

- POLLUTION AGENDA
- React and Cure
- Establish scientific proof of environmental degradation, its significance and its causes
- Track performance and report to the public
- Prevention
- Precautionary methods established for new chemicals, byproducts and projects.

- NATURE AGENDA
- **Sustainable yield** = the amount needed to maintain nature's services at the same or increasing level over time
- Annual allowable catch
- Effective use of nature

- **SUSTAINABLE DEVELOPMENT** = process of developing that "meets the needs of the present without compromising the ability of future generations to meet their own needs"
- Development that integrates ecological, social and economic considerations within natural limits

- OPPORTUNITIES AGENDA
- Taking advantage of the thousands of upcoming opportunities to better out world

- ACID RAIN (Between 0 and 5 on Ph Scale)
- Acid deposition primarily results from the transformation of **Sulphur dioxide** (Ore smelting, coal-fired power generators and natural gas processing) and **nitrogen oxides** (combustion of fuels in motor vehicles, residential and commercial furnaces) into **sulphuric acid**, **ammonium nitrate** and **nitric acid**
- Water or soil systems that lack alkalinity - such as a lime base - cannot neutralize acid naturally
- **critical load** is a measure of how much pollution an ecosystem can tolerate
- **target load** is the amount of pollution that is deemed achievable and politically acceptable
- As a lake becomes more acidic, crayfish and clam populations are the first to disappear, then various types of fish. As fish stocks dwindle, so do populations birds.
- Some life forms actually benefit from the increased acidity. Lake-bottom plants and mosses, for instance, thrive in acid lakes, which eat all the nutrients in the water (BAD)

- Acid rain damages the surfaces of leaves and needles, reduces a tree's ability to withstand cold, and inhibit plant germination and reproduction.
- Acid rain also depletes supplies of calcium and magnesium from soils
- Causes Smog

Lecture 4 = Persistent Organic Pollutants

- A class of chemicals that persist in the environment, are capable of long-range transport, accumulate in human and animal tissue, and have significant long term impacts on human health and the environment.
- **Include** → PCB's, Pesticides (DDT), Byproducts (Dioxins), Industrial Chemicals, Teflon, Scotch Guard
- **Causes** → Birth Deformities, Cancer, Behavioral Change, moves from Mother to Child
- **Discovered** → in Great Lakes while chasing Red Herring in the Arctic Ice Fields
- **Main source** → North and Central America, Eastern Europe, Southeast Asia
- **Travels** → Wind, Ocean, Rain, Food Chain, Grasshopper Effect
- **Grasshopper Effect** = Releases into air, then air cools and settles, then ground warms and air rises, wind moves, reoccurs over and over
- **Solution** → do not allow any new POPs, manage existing POPs, Changes in laws and regulations of all countries, Canadian and International Funds
- DDT can stop Malaria which sickens 300 to 500 million poor people annually, killing 2.7 million
- DDT inventor won the Nobel Peace Prize
- INUIT
- Inuit are struggling to find their rightful place in the world
- The Arctic Food chain is full of POP's
- Homeland is slowly melting
- This assessment projects massive depletion of summer sea-ice, with the virtual disappearance of polar bears, walrus, and some species of seals and marine birds within the lifetime of my grandson.
- The global POPs convention Canada first to ratify this convention and first to commit money to implement it
- **NCP = Northern Contaminants Program**
- The Inuit people of Nunavut are now observing thunderstorms for the first time in their memory.

Lecture 5 = Kevin Brady's Guest Lecture

- Founding partner and Director of Five Winds International.
- Degree in Biology and Environmental Studies
- **Five Wind International** = Engineering Firm that integrates environment into its projects
- 80% of impacts is fixed at the design phase
- Make use of Eco-Friendly build materials, use of natural lighting and natural ventilation
- **NPRI = National Pollutant Release Inventory**
- **7 Fronts of Sustainability**
 - Eliminate Waste
 - Eliminate Harmful Emissions
 - Renewable Energy
 - Closing the Loop
 - Resource Efficient Transportation
 - Sensitivity Hookup
 - Redesign Commerce

Lecture 6 = Engineers Without Borders

- EWB is a registered Canadian charity that helps people in developing communities gain access to **appropriate technologies** that will improve their lives
- 3 Billion people live on less than \$1 per day
- 1 Billion people lack access to clean drinking water
- 800 Million people go hungry every day
- Jack Jenson went to Zimbabwe....Chilies to stop Elephants eating crops

Lecture 7 = Climate Change

- CO2 levels in the atmosphere today are more than 30% higher than pre-industrialized levels
- Average global temperature has increased by approximately 0.60
- Coastal erosion means buildings, roads and railways will have to be moved
- Canada can bring in Refugees, give financial assistance
- 60 to 80% reductions in Greenhouse Gases to stabilize atmosphere
- Global Convention 1992
- Kyoto Protocol 1997 – Signed in Japan
- “Kyoto Gap”: 270 Million tonnes CO2 equivalent
- Sweden has greatly surpassed the Kyoto target, Canada is farthest from it.
- The Greatest change since industrial revolution is required to rid the world of Greenhouse Gases

Lecture 8 = Unknown Title

- HOT IN PLACE ASPHALT
- Defined as a process of correcting asphalt pavement by softening the existing surface with heat, mechanically removing the pavement surface, mixing with recycling agent, possibly adding virgin asphalt and/or aggregate and replace it on the pavement without removing the recycled material from the original pavement site.
- Obvious benefits from money to environment saving

- CANADIAN GREEN BUILDING COUNCIL
- The Canmore Civic Center a cultural, administrative, communications and information heart for the Town. Housing the municipal government offices, Council Chamber and the new location for the Canmore Museum and GeoScience Center
- Green building objectives included site considerations, massing and orientation, energy modeling, passive solar heating, natural day lighting, energy efficient electrical systems, the use of recycled construction materials and sustainable construction management methods.

- BIOFUEL

- any fuel that derives from biomass — recently living organisms or their metabolic byproducts,
- such as manure from cows
- ethanol, biodiesel, and several other liquid and gaseous fuels
- Increasing the use of biofuels can
- Improve energy security, reduce greenhouse gas and pollutant emissions, improve vehicle performance, enhance rural economic development and, under the right circumstances, protect ecosystems and soils.