INTRODUCTION TO NATURAL RESOURCES

ENRT 110

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Topics

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- Course Overview
- Section 1 – Natural Resources
- Section 2 – Consuming Resources
- Section 3 – Renewable & Non-Renewable
- Section 4 – Threats to Natural Resources
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- What’s Next
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Course Overview

COURSE INTRODUCTION

- Brief description of the course
- Importance in the Environment Resources Technology Program
- Relevance to students interested in natural resources

COURSE GOALS AND OVERVIEW

- Overview of the natural resources sector
- Emphasis on ecology and management issues
- Integration of scientific inquiry with cultural and economic values

COURSE STRUCTURE

- Description of lecture format and topics
- Overview of field lab exercises
- Integration of First Nations traditional ecological knowledge

SUBJECT AREAS COVERED

- Forestry
- Wildland Recreation
- Wildlife
- Mining
- Fisheries
- Rangeland
- Hydrology

FIRST NATIONS AND NATURAL RESOURCES

- Role of First Nations in the Resource Sector
- Incorporating traditional ecological knowledge

LEARNING OUTCOMES

- Define key terminology and concepts for each subject area
- Describe and identify key specimens from field lab exercises
- Understand various ecosystem processes from lectures
- Develop insight into the role of First Nations in the Resource Sector
- Impact of climate change on species diversity and ecosystem functions
- Importance of natural resources sustainability

COURSE MATERIALS AND RESOURCES

- Textbooks and Reading Materials
- Online Resources and Platforms
- Field Equipment and Lab Requirements

ASSESSMENT AND GRADING

- Overview of grading criteria
- Description of assignments, projects, and exams
- Participation and assessments

EXPECTATIONS AND PARTICIPATION

- Participation expectations
- Communication

IMPORTANT DATES AND DEADLINES

- Key dates for assignments and exams

Section I
Natural Resources

WHAT ARE NATURAL RESOURCES?

- **Natural resources are resources that exist without any actions from humans.**
- On earth, natural resources include;
  - Sunlight
  - Water (rivers, lakes, oceans, rain)
  - Soil and Minerals
  - Vegetation (forests, plants, crops)
  - Animals (wild and domesticated)
  - Natural Gas
  - Coal
  - Oil
  - Wind
  - Hydro
- Natural resources are all interconnected with each other.
- If one is taken away or negatively impacted, it will affect the supply or quality of all others.
  - For example, if water quality is reduced in an area, the vegetation, soil, animals and even the air in that area will be negatively impacted.

NATURAL RESOURCES

- Natural resources are available to sustain the very complex interaction between living things and non-living things.
- In 2017, the world is used more than 100 billion tonnes of natural resources per year for the first time ever, and that amount has increased.
- "No country is meeting the basic needs of its citizens while also operating within the physical boundaries of our planet," said Marc de Wit, a director at the non-profit Circle Economy.
- Developed countries consume resources more than under-developed countries.

Section 2 Consuming Natural Resources

NATURAL RESOURCE CONSUMPTION

- Average natural resource consumption around the world;
  - a person in **Africa** consumes about ***10kg*** of resources per day.
  - a person in **Asia** consumes about ***14kg*** of resources per day.
  - a person in **Europe** consumes about ***36kg*** of resources per day.
  - a person in **North America** consumes about ***90kg*** per day.

NATURAL RESOURCE CONSUMPTION

- Natural resources can be consumed directly or indirectly by humans.

How do we **directly** consume natural resources?

How do we **indirectly** consume natural resources?

NATURAL RESOURCE CONSUMPTION

Direct Consumption

- Humans depend directly on forests for food, biomass, health, recreation, etc.
- Cutting down a tree and burning it for heat

Indirect Consumption

- Humans use goods or services that come from processing the original natural resources.
- Humans depend Indirectly on forests to act as climate control, flood control, storm protection and nutrient/mineral cycling.

NATURAL RESOURCE CONSUMPTION

- Human consumption of earth's natural resources has tripled in the past 40 Years.
- The richest countries consume, on average, 10x as much of the available resources as the poorest and 2x as much as the world average.

In what forms do humans consume natural resources?

NATURAL RESOURCE CONSUMPTION

- Our natural resource uses can be simplified into 3 main categories;
  1. **Food and Drink**
  2. **Mobility**
  3. **Housing and Infrastructure**
- Aside from those main categories, humans use natural resources for every aspect of our lives, not just the necessities to live.

NATURAL RESOURCE CONSUMPTION

1) Food and Drink

- This includes agricultural products as well as naturally occurring foods such as game, fish from fresh water and seas, seeds and nuts, medicines, herbs and plants.
- They also include drinking water, as well as water for sanitation and household use.
- Ceramic dishes, cutlery (spoons, forks and knives), cans, milk packages, paper and plastic cups, are all made from raw materials which come from our natural resources.

NATURAL RESOURCE CONSUMPTION

2) Mobility

- Automobiles, trains, boats, and airplanes,
- This includes all the fuel that powers them.

NATURAL RESOURCE CONSUMPTION

3) Housing and Infrastructure

- We use vast amounts of natural resources to build all the houses, public places, roads and constructed objects that make up our cities and towns.
- This infrastructure requires great amounts of energy for heating and cooling, and they need huge amounts of construction materials, such as wood, metals, plastic, stone and other materials.

Section 3 Renewable & Non-Renewable Resources

RENEWABLE RESOURCES

WHAT ARE RENEWABLE RESOURCES?

- **Renewable Resources can be replaced by nature at a rate close to the rate at which they are used by humans.**
- Renewable resources are those that are constantly available (like water) or can be reasonably replaced or recovered (like vegetative lands).

WHAT ARE RENEWABLE RESOURCES?

- Animals can be considered renewable resources as they can reproduce offspring to replace adult animals.
  - If renewable resources come from living things (such as trees and animals), they can be called **organic renewable resources**.
  - If renewable resources come from non-living things (such as water, sun and wind), they can be called **inorganic renewable resources**.

SOLAR POWER

- Solar energy is the most abundant of all energy resources a is continuously available at a rate10,000x greater than the rate at which humankind consumes energy.
- Solar technology provides various energy solutions, including heating, cooling, lighting, and electricity, through photovoltaic panels or concentrated solar power systems.
- Solar panels, whose costs have dropped significantly, now offer a financially viable and widespread energy option with a lifespan of about 30 years, adaptable to different country's energy mixes.

GEOTHERMAL POWER

- Geothermal energy taps into the Earth's internal heat, with extraction via wells from natural geothermal reservoirs.
- Hydrothermal reservoirs are naturally hot and permeable, while enhanced geothermal systems may require hydraulic stimulation to improve heat extraction.
- Geothermal fluids are used to generate electricity with mature and reliable technology that has been in use for over a century.

WIND POWER

- Wind energy is produced using wind turbines on land and water, with recent advancements including taller structures and larger rotors to increase electricity generation.
- The global technical potential for wind energy is vast, surpassing current electricity needs, with high potential for expansion in many world regions.
- While optimal wind energy sites may be remote, offshore wind farms, in particular, present enormous potential for power generation.

HYDROPOWER

- Hydropower captures the energy from flowing water in rivers or reservoirs to generate electricity, with the capacity to operate from both stored water and natural river flows.
- Beyond electricity generation, hydropower facilities offer additional benefits like water supply for drinking and irrigation, as well as flood control and navigational support.
- While hydropower is a dominant renewable energy source, it can be affected by climate change and may have ecological impacts, although small-scale hydro is considered more environmentally friendly and suitable for isolated areas.

BIOENERGY (BIOMASS)

- Bioenergy is derived from organic materials, or biomass, such as wood, agricultural crops, and manure, predominantly used in rural areas of developing countries for cooking, lighting, and heating.
- Modern biomass systems use dedicated energy crops, agricultural and forestry residues, and organic waste streams for cleaner energy production.
- While bioenergy generates greenhouse gases, emissions are lower compared to fossil fuels; however, its use should be controlled to prevent environmental issues like deforestation and land-use changes.

ADVANTAGES OF RENEWABLES

- Every day humans use and consume products and services that need to be created, harvested, manufacture, and grown, for survival, health and comfort.
- How these products get to us for our us varies greatly, but they all require the use of energy of some kind, whether human or machine.
- As the human population grows, so does our need and desire for more and more products and services, this requires increased energy to supply those products for us.
- This increase in consumption has a huge, lasting effect on the earth. Switching to renewable energy sources has many benefits for humans and other species.

ADVANTAGES OF RENEWABLES

Renewable energy is eco-friendly

- Renewable energy is considered clean, with low or zero emissions of carbon and greenhouse gases, unlike fossil fuels which significantly contribute to global warming and air quality degradation.

Sustainability of Renewable Energy

- This means that they do not deplete over a lifetime and there is zero possibility that they will run out. Sources of energy like fossil fuels (oil, gas, and coal) are considered limited resources and there is strong possibility that they will run out in the future.

ADVANTAGES OF RENEWABLES

Reliability of Wind and Solar Energy

- Wind and solar power systems are resilient to widespread failure due to their distributed and modular nature; local weather impacts or equipment damage affect them less than centralized power sources.

Job creation

- Renewable energy makes real economic sense because it is a cheaper alternative to most traditional sources of energy. Since the inception of renewable energy, new and stable jobs have been added to most world economies

ADVANTAGES OF RENEWABLES

Less maintenance of facilities

- Once infrastructure for the harnessing of the renewable resource is laid down, there is low to zero maintenance required

Boosts public health

- Greenhouse, carbon and sulfur compounds emitted by fossils fuels are risky to our health if inhaled over time. This is reason enough to consider renewable energy moving forward

ADVANTAGES OF RENEWABLES

Renewable energy has stabilized global energy prices

- Switching to renewable energy can lead to more stable energy prices worldwide, as costs are largely associated with initial technology installation rather than fluctuating market conditions like those affecting fossil fuels.

DISADVANTAGES OF RENEWABLES

The electricity generation capacity is still not large enough

- It is challenging to generate large quantities of power with renewable energy technology compared to traditional forms of energy generation like fossil fuel. Fossil fuel still produces large quantities of electricity today

Renewable energy can be unreliable

- Renewable energy technologies totally depend on the weather (Ex: sun and wind) to be able to harness any energy. In case atmospheric conditions are not good enough, renewable energy technologies would lack the ability to generate any electricity

DISADVANTAGES OF RENEWABLES

Low-efficiency levels

- Renewable energy technologies are relatively new to the market, they still lack as much efficiency as necessary to provide large-scale power to people

Requires a huge upfront capital outlay

- Setting up renewable energy generation facilities requires a huge financial expense. Installation of wind turbine, solar panels, and hydroelectricity plants are relatively expensive

NON-RENEWABLE RESOURCES

WHAT ARE NON-RENEWABLE RESOURCES?

- **Non-renewable resources cannot be re-made or re-grown at a scale comparable to their consumption in a human timeline, or not remade at all.**
- Non-renewable resources exist in a fixed amount.
- Non-renewable resources are renewed very slowly or not at all.

WHAT ARE NON-RENEWABLE RESOURCES?

- Examples include fossil fuels. Minerals are also non-renewable because even though they form naturally in a process called the rock cycle, it can take thousands of years, making them non-renewable.
- Some animals can also be considered non-renewable because if people hunt for a particular species unsustainably, they will become extinct.
  - **Inorganic non-renewable resources** come from non-living things – such as minerals, soil and rocks.
  - **Organic non-renewable resources** are those non-renewable resources that come from living things — such as fossil fuels (*organic life, dinosaurs*).

COAL POWER

- Coal is a non-renewable energy source produced by carbonization, where ancient organisms transform into various ranks of coal, from peat to high-grade anthracite.
- It is a dependable energy source due to its year-round availability and versatility in usage, despite being significantly harmful to the environment and health.
- Coal mining poses severe risks, including exposure to toxic substances and cave-in dangers, and burning coal contributes to air pollution and respiratory diseases.

NUCLEAR POWER

- Uranium, primarily U-235, is used in nuclear energy production; while the energy is renewable, uranium itself is not and takes long periods to form under rocks.
- Nuclear power, a major electricity source worldwide, harnesses energy through nuclear fission, where an atom's nucleus is split in controlled nuclear power plants.
- Despite its lack of atmospheric pollution, nuclear energy is costly and complex to harness, and it generates radioactive waste that can cause serious health issues, including various cancers.

FOSSIL FUELS

- Fossil fuels are non-renewable energy sources formed from the remains of ancient plants and animals, undergoing millions of years of heat and pressure beneath the Earth's surface.
- They include coal, oil, and natural gas, which are used for electricity generation, heating, and transportation but are limited in supply and contribute to environmental pollution.
- Burning fossil fuels releases carbon dioxide, a greenhouse gas, leading to climate change, and their extraction and use can result in significant ecological and health impacts.

NATURAL GAS

- Natural gas, mainly methane, is considered clean energy but is not entirely pure, emitting carbon dioxide and water vapor upon combustion.
- It is extracted using methods like hydraulic fracturing, which fractures rock with high-pressure water to release gas from underground deposits.
- The extraction process is economical but can cause environmental issues such as mini earthquakes and water contamination.

ADVANTAGES OF NON-RENEWABLES

Accessibility of Nonrenewable Energy

- Nonrenewable energy sources are globally abundant and transportable, offering a reliable energy option even for those in remote locations.

Economic Impact of Nonrenewable Resources

- The nonrenewable energy sector generates significant employment through the extraction, transportation, and refining processes, contributing to job creation.

Storage and Stability of Nonrenewable Resources

- Nonrenewable resources are particularly easy to store, which allows them to be effectively used for long-term energy needs.

ADVANTAGES OF NON-RENEWABLES

Cost-Effectiveness of Non-Renewable Energy

- Non-renewable energies, such as coal, oil, and natural gas, are abundant and affordable, making them a cost-efficient choice compared to some renewable sources.

Economic Benefits of Energy Industries

- The non-renewable energy sector, including oil drilling and coal mining, generates substantial profits and drives economic growth.

Domestic Utility of Non-Renewable Resources

- Non-renewable resources are readily accessible and widely used in household activities, providing a convenient energy source for daily needs.

DISADVANTAGES OF NON-RENEWABLES

Impact of Greenhouse Gas Emissions

- The burning of fossil fuels emits greenhouse gases, which contribute to climate change, severe weather events, increased wildfires, ocean acidification, smog, and ozone layer depletion.

Acid Rain and Its Effects

- Fossil fuel combustion leads to atmospheric pollution, resulting in acid rain, which adversely affects plant growth and reduces the nutritional quality of crops.

Health Risks from Non-Renewable Energy

- Non-renewable energy products and by-products, particularly from fossil fuels, pose serious health risks, including various cancers and respiratory diseases.

DISADVANTAGES OF NON-RENEWABLES

Finite Nature of Nonrenewable Energy

- Nonrenewable energy sources, such as oil, coal, and natural gas, are formed over eons and are not replenishable within human timescales, leading to their eventual depletion.

Environmental Pollution and Health Hazards

- The use of nonrenewable energy results in pollution due to non-biodegradable byproducts, which harm the environment and pose serious health risks.

Section 4 Threats to Natural Resources

THREATS TO NATURAL RESOURCES

- Urbanization
- Invasive species
- Over-exploitation
- Environmental degradation
- Population growth
- Resource consumption
- Climate change and global warming
- Habitat conversion

THREATS TO NATURAL RESOURCES

- **Urbanization**
  - The population shift from rural ("country") to urban ("city") living, the gradual increase in the population of people living in urban areas, and the ways in which each society adapts to this change. Less connection between people and the natural world.
- **Invasive Species**
  - A species that is not native to a specific area, that spreads and negatively impacts native species populations.
  - Invasive species can cause damage to the environment, human economy or human health.

THREATS TO NATURAL RESOURCES

- **Over-exploitation**
  - The unsustainable use of natural resources which occurs when harvesting exceeds the natural reproduction of the resource.
  - Continued overexploitation can lead to the destruction of the resource.
- **Environmental Degradation**
  - The deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution.
  - Environmental Degradation is defined as any change or disturbance to the environment perceived to be harmful.

THREATS TO NATURAL RESOURCES

- **Population Growth**
  - The increase in the number of individuals in a population.
- **Resource Consumption**
  - The overconsumption of non-renewable or renewable resources.

THREATS TO NATURAL RESOURCES

- **Climate Change and Global Warming**
  - A change in the statistical distribution of weather patterns when that change lasts for extended periods of time (ex: decades to millions of years).
- **Habitat Conversion**
  - The elimination or severe decrease of the integrity of a natural habitat caused by a major, long-term change in land or water use.
  - In both terrestrial (land) and aquatic (water) ecosystems, conversion of natural habitats can occur as the result of severe pollution.

Section 5 Managing Natural Resources

MANAGING NATURAL RESOURCES

- Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations
- Natural resource management deals with managing the way in which people, natural landscapes and species interact with one another

MANAGING NATURAL RESOURCES

- Natural resource management is complex, encompassing the management of ecological and hydrological cycles, climate, flora and fauna, and geographical factors.
  - These elements are interrelated, and alterations in one can lead to extensive and potentially irreversible impacts.
- Effective management requires balancing the diverse interests of various stakeholders, which include political, policy, and economic considerations, as well as the demarcation of geographical boundaries.
- It necessitates recognition and integration of Indigenous rights, land claims, treaties, and Traditional Ecological Knowledge alongside contemporary management practices.

MANAGING NATURAL RESOURCES

- Community-based natural resource management (CBNRM) approach combines conservation objectives with the economic benefits for rural communities
- This approach has 3 key assumptions:
  1. Locals are better placed to conserve natural resources
  2. People will conserve a resource only if benefits exceed the costs of conservation
  3. People will conserve a resource that is linked directly to their quality of life

MANAGING NATURAL RESOURCES

- When a local people's quality of life is enhanced, their efforts and commitment to ensure the future well-being of the resource are also enhanced
- Basically, if people care about something, they will protect it – if people will gain something by protecting a resource or lose something by not protecting a resource, they are more likely to want it protected

FIRST NATIONS LAND MANAGEMENT ACT

- The First Nations Land Management Act (Bill C-49) was enacted and given royal assent on June 17, 1999
- The Framework Agreement is the document that sets out the terms and conditions under which a First Nation can establish its own land governance regime and remove its reserve lands from the Minister's control under the Indian Act

FIRST NATIONS LAND MANAGEMENT ACT

- By signing the Framework Agreement, **these First Nation communities can now begin the process of opting out of 34 land-related sections of the Indian Act and assume greater control over their reserve land and resources**

FIRST NATIONS LAND MANAGEMENT ACT

- The Act states that title to First Nation Lands will not be affected by the Act and that these lands will continue to be reserves and to be constitutionally protected
  - First Nation lands are also protected against surrender for sale
  - If land is ever voluntarily exchanged by a First Nation for other land, the new reserve land received by the First Nation would be protected in the same way

FIRST NATIONS LAND MANAGEMENT ACT

- The Act allows First Nations to opt out of 34 sections of the Indian Act related to land, resources and environmental management.
- Opting out of these sections of the Indian Act removes Ministerial oversight and approval relating to the development and use of First Nation land.
- It also makes two key elements available;

1. Land Management, and
2. First Nation law making.

FIRST NATIONS LAND MANAGEMENT ACT

- There is a wide variety of benefits for First Nations through this Act, some specifically focused on resource management. These include;
  - Direct collection of land revenue (from resource use and sale),
  - Community control over reserve lands and resources utilizing the traditional practices and traditions,
  - First Nations can create their own environmental assessment and protection laws,
  - Ability to create modern offences and enforcement for breach of First Nations laws, and
  - Recognition of the inherent right to govern reserve lands and resources.

FIRST NATIONS LAND MANAGEMENT ACT

- Once a First Nation has joined the Act, it is able to receive two types of funding:
  1. Developmental funding for developing a land code, negotiating an individual agreement and holding a ratification vote.
  2. On-going operational funding for managing land, natural resources and environment, as determined by a formula and set out in the individual agreement.

FIRST NATIONS LAND MANAGEMENT ACT

- First Nations operating within the Act are not able to return to Indian Act land management.
- As of 2023, over 300 First Nations have entered the Act and are either developing or operating under their own land codes.
- There is no deadline to join the FNLM. Applications are reviewed on an ongoing basis.

Key Points

KEY WORDS AND IDEAS

- Natural Resources.
- Renewable & Non-Renewable Natural Resources
  - Organic
  - Inorganic
- Examples of Renewable & Non-Renewable Energy.
- Threats to Natural Resources.
- Advantages and Disadvantages of Natural Resource Energies.
- First Nations Land Management Act.

What’s Next?

INTRO TO NATURAL RESOURCES

- Climate Change
- Traditional Ecological Knowledge
- Fisheries Management
- Hydrology
- Forest and Forest Ecology
- Wildlife Ecology and Identification
- Mining
- Rangeland Ecology
- Wildland Recreation

Course Assessments