ENH 617
Lecture 1
Sept 6, 2016
Dr. Anne Harris

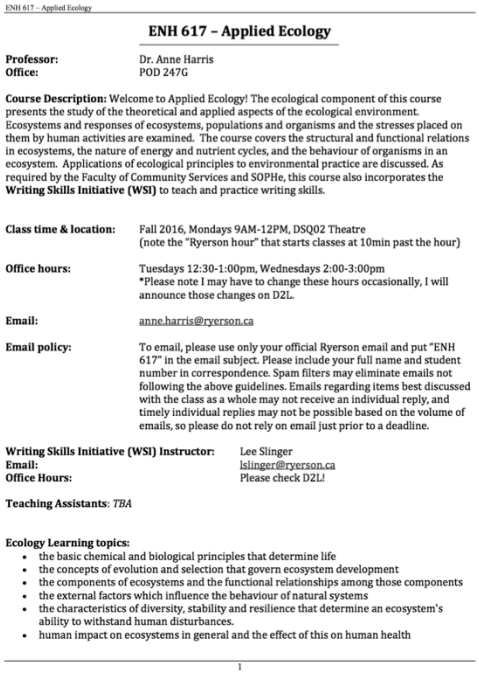
- Summer events
- Course orientation: D2L, expectations, evaluation
- What is Ecology?
- Environment, resources and society
- What is peer reviewed science?
- WSI Introduction

Summer Events

- Class discussion

- **Ecology**: the study of interactions between organisms (living things) and their environment
- **Applied Ecology**: typically emphasizes influence/role of human systems in these interactions

Course Intro



ENH 617 – Applied Ecology

ENH 617 – Applied Ecology

Professor: Dr. Anne Harris
Office: POD 247G

Course Description: Welcome to Applied Ecology! The ecological component of this course presents the study of the theoretical and applied aspects of the ecological environment. Ecosystems and responses of ecosystems, populations and organisms and the stresses placed on them by human activities are examined. The course covers the structural and functional relations in ecosystems, the nature of energy and nutrient cycles, and the behaviour of organisms in an ecosystem. Applications of ecological principles to environmental practice are discussed. As required by the Faculty of Community Services and SOPHe, this course also incorporates the **Writing Skills Initiative (WSI)** to teach and practice writing skills.

Class time & location: Fall 2016, Mondays 9AM-12PM, DSQ02 Theatre
(note the "Ryerson hour" that starts classes at 10min past the hour)

Office hours: Tuesdays 12:30-1:00pm, Wednesdays 2:00-3:00pm
*Please note I may have to change these hours occasionally, I will announce those changes on D2L.

Email: anne.harris@ryerson.ca

Email policy: To email, please use only your official Ryerson email and put "ENH 617" in the email subject. Please include your full name and student number in correspondence. Spam filters may eliminate emails not following the above guidelines. Emails regarding items best discussed with the class as a whole may not receive an individual reply, and timely individual replies may not be possible based on the volume of emails, so please do not rely on email just prior to a deadline.

Writing Skills Initiative (WSI) Instructor: Lee Slinger
Email: lslinger@ryerson.ca
Office Hours: Please check D2L!

Teaching Assistants: *TBA*

Ecology Learning topics:
- the basic chemical and biological principles that determine life
- the concepts of evolution and selection that govern ecosystem development
- the components of ecosystems and the functional relationships among those components
- the external factors which influence the behaviour of natural systems
- the characteristics of diversity, stability and resilience that determine an ecosystem's ability to withstand human disturbances.
- human impact on ecosystems in general and the effect of this on human health

1

Grading

- 30% - Midterm (October 4)
- 30% - Ecological Issue Report (Nov 1)
- 5% Participation (i>clicker)
- 35% - Final Exam (cumulative)

i>clickers

- See info on D2L
- Can use either i>clicker device or REEF app

Ecological Issue Report

ENH 617 Ecological Issue Report

For this project you will be asked to apply the concepts of ecology and writing skills instruction to prepare a report on **one** of the topics listed below. A concise summary of an issue, with evidence support, is often called a "briefing note" or "précis". Health or environmental practitioners often have to prepare such summaries in both the private and public sector.

Choose **one** of the following topics:

- **Escarpment blues**
  Begin by listening to Burlington native Sarah Harmer sing her song "Escarpment Blues" on CBC https://youtu.be/52vXPZAkDug
  The lyrics give you an introduction to (one side of?) a controversial ecological topic that affects the GTHA (hint: in addition to the title of this song, you should be able to describe the issue using a word beginning with "q").

- **The case of the drowned rat**
  The drowned rat (*Melomys rubicola*) made news in 2016. What made this species so newsworthy?

For your selected topic, ensure your report addresses the following:

- What is the issue?
- What is the evidence for the relevant trends?
- What is known about the causes or effects?
- What is the effect on related ecosystems?
- What is the expected or current effect on humans (e.g. health, economy)?
- What remediation or prevention efforts are effective?

Include any other details you determine would be important to explain the issue to a person not familiar with the topic.

The word guideline for the report is **500 words**. This does not include your references. You will be penalized for exceeding this limit by more than 50 words.

The information you provide should include references to appropriate documentation and sources. Please cite at least **three (3)** academically appropriate sources: at least **one (1)** of these should be a *peer-reviewed scientific article*. Follow the APA style guide to format your in-text citations and reference list. Be sure to write only in your own words and be aware of Ryerson's strict policies on plagiarism.

Grammar, spelling and proper reference formatting will be counted for 20% of the report marks. Please note that the entire report mark will depend on the text of the report being comprehensible so that the content can be understood and evaluated.

Pollinating animals help plants reproduce by distributing plant pollen between flowers (Cambell, Reece, & Mitchell, 1998). Worldwide, 87 of the leading food crops rely on animal pollinators for reproduction (Klein et al., 2007). A common animal pollinator is the western honeybee (*Apis mellifera*). Since 2006, the term "colony collapse disorder" (CCD) has been used to describe loss of adult bees from established hives. Although it is common for bee populations to be lost in the winter (Kevan, Guzman, Skinner, & van Engelsdorp, 2007), apiarists (professional beekeepers) began to express concerns in 2006 that CCD represented a new threat to these key pollinators (Watanabe, 2008).

Survey data have been collected to document the problem of CCD and to define its symptoms (van Engelsdorp, Hayes, Underwood, & Pettis, 2008). A key finding of CCD symptom studies is that dead adult honey bees are not found near or in their hives, they instead seem to be simply "missing" (van Engelsdorp et al., 2009). Many factors have been hypothesized to contribute to CCD. Suspected factors include parasites, such as varroa mites (*Varroa destructor*) or a virus known as Israeli acute paralysis virus (IAPV) (Watanabe, 2008).

Recently, scientists and journalists (Sygo, 2014) have discussed the potential for a certain class of pesticides known as neonicotinoids to contribute to CCD. Used to control pest insects, neonicotinoids were intended to be kept at levels that would be less than a lethal dose for bees. However, researchers are now exploring effects on bees that receive less than a killing dose. For example, low doses of neonicotinoids could impact the memory and behaviour of honey bees, meaning that bees might not be able to locate their food sources

2

Anne Harris 2016-8-17 11:18 AM
Comment [3]: In text citations use the APA 6th edition style. https://owl.english.purdue.edu/owl/resource/560/03/

Anne Harris 2016-8-17 11:32 AM
Comment [4]: In scientific writing, a reference or citation following a sentence provides evidence for the statement made in the sentence. You might think of it as something like "go here for the proof that what I just told you is true". Notice I write my own sentences myself rather than directly quoting my sources (see note below the paper for more details)

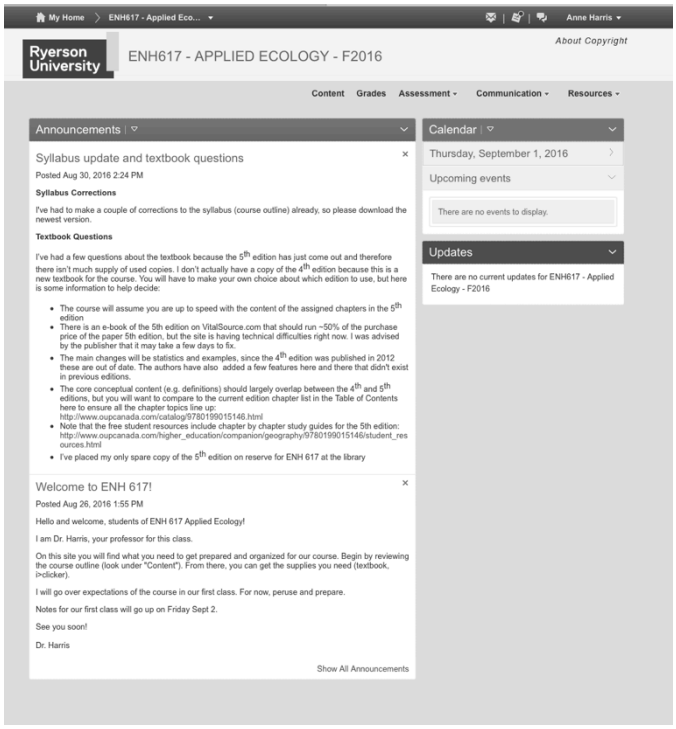
Anne Harris 2014-9-4 12:47 PM
Comment [5]: Write acronyms (e.g. CCD, UN, EMF etc.) out in full the first time you use them. Thereafter, you can just refer to the acronym.

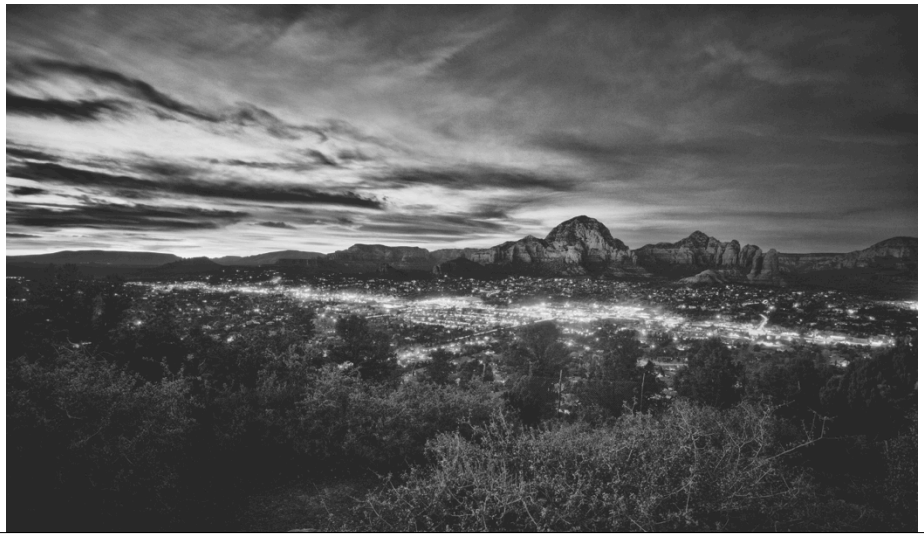
Anne Harris 2014-9-4 12:49 PM
Comment [6]: This paragraph helps address the evidence for the trends and explains some of the unique features of this issue.

Anne Harris 2014-9-4 12:48 PM
Comment [7]: Here is another acronym. Notice it is written out in full the first time.

Anne Harris 2014-9-4 12:53 PM
Comment [8]: This paragraph discusses what we know about the causes of CCD.

D2L Demo





CHAPTER ONE
Environment, Resources, and Society

Introduction: Change and Challenge

- Nine of the 10 hottest years in global records have occurred since 2000.
- There is strong evidence that human activities have become a main driving force behind environmental change.
- These changes are happening more abruptly and with greater magnitude than they did previously.

Introduction: Change and Challenge, cont'd

- These changes threaten societal well-being – society must respond thoughtfully and deliberately.
- Significant economic growth during the past 35 years due to population growth and increased consumption.
- How do we meet basic human needs and protect the integrity of biophysical systems?

Introduction: Change and Challenge, cont'd

- How are "environment," "resources," and "society" defined?
  - We use indicators (e.g. ecological footprints) to measure environmental change and response and discuss how these indicators are used.

Defining Environment and Resources

- The environment includes the atmosphere, hydrosphere, cryosphere, lithosphere, and biosphere in which humans, other living species, and non-animate phenomena exist.

- Resources are more specific and include forests, wildlife, oceans, rivers, lakes, minerals, and petroleum.

Defining Environment and Resources, cont'd

- Anthropocentric view
  - Value is defined relative to human interests, wants, and needs. INSTRUMENTAL VALUE

- Ecocentric or biocentric view
  - Defined as an aspect of the environment that is valued simply because of its existence INTRINSIC VALUE

Three Waves Regarding Approaches to Environmental Management

- First wave (late nineteenth century)
  - Inventory, protect and extend (conserve) wilderness areas

- Second wave (early twentieth century)
  - Identify environmental degradation—urge governments to reduce the damage (environmental activism)

- Third wave (late twentieth century)
  - Remediate environmental degradation (sustainable development)

Alternative Approaches to Understanding Complex Natural and Socio-economic Systems

- Disciplinary
  - This approach is organized around the concepts, theories, assumptions, and methods associated with an academic discipline.
  - May limit understanding of complex systems.

- Multidisciplinary
  - Specialists examine an issue from each of their disciplinary perspectives, and their findings and insights are synthesized for an increasing understanding.

Alternative Approaches to Understanding Complex Natural and Socio-economic Systems, cont'd

- Cross-disciplinary
  - A specialist borrows concepts, theories, and methods from other disciplines to enhance their perspective.
  - May enhance understanding; lead to misunderstandings.

- Interdisciplinary
  - Specialists work together from the beginning of a project—synthesis and integration of understanding.
  - Time-consuming
  - Requires trust, patience, and self-confidence

Alternative Approaches to Understanding Complex Natural and Socio-economic Systems, cont'd

- Transdisciplinary
  - Extends the interdisciplinary perspective by seeking a holistic understanding that transcends disciplinary boundaries, not viewing them in the context of any one discipline and weighing each area equally.
  - Can enhance understanding or lead to confusion and may lead to information overload .

What do scientists do?

- Identify a problem
- Find out what is known about the problem
- Ask a question to be investigated
- Propose a **scientific hypothesis**
- Make testable predictions
- Gather **data** through **experiments and observation**
- Accept or reject the hypothesis
- **Scientific theory**: well-tested and widely accepted hypothesis.

Science-Based Management of Resources and Environment

- Mills et al. (2001) provide five guidelines for contributions by scientists for effective management of resources and the environment:
  1. Focus the science on key issues, and communicate it in a policy-relevant form.
  2. Clarify issues, identify potential management options, and estimate consequences of decisions.
  3. Clearly and simply communicate key scientific findings to all participants.
  4. Evaluate whether or not the final decision is consistent with scientific information.
  5. Avoid advocacy of any particular solution.

Spotlight: What is Peer Review?

The process by which scientific research results are published.

- Scientists submit articles to journals.
- Journals send these articles to other scientists *with specialized expertis*e to review.
- The review may:
  - Ask questions about the methods used.
  - Request additional data or analyses to aid interpretation.
  - Call attention to other research that might be relevant.
- Articles may be rejected, returned for revisions or accepted.
- Published scientific articles typically reflect several months of review and revision.

War on Science?

- Characteristics of the war on science:
  1. Reducing funds for government units or organizations whose research has produced findings that challenge government initiatives.
  2. Not allowing government scientists to publish their research findings in journal articles or to present them at conferences unless the material has first been reviewed and approved by the relevant minister's office.

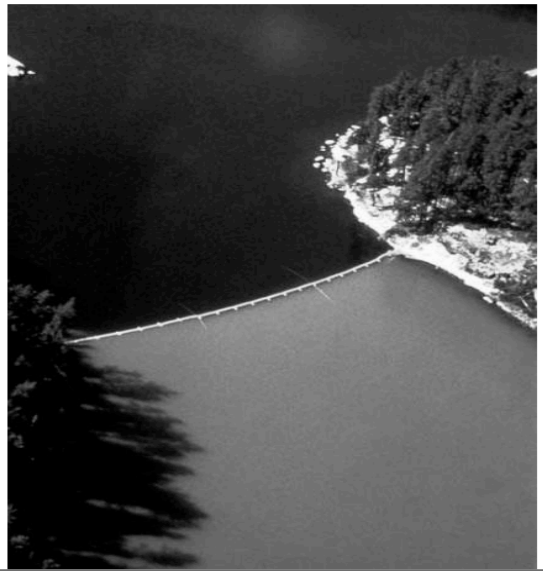
War on Science? cont'd

  3. When government scientists make a conference presentation or are interviewed by the media, having a spokesperson from the relevant minister's office accompany them and determine which questions can be answered.
  4. Discrediting or raising questions about research findings that challenge a government's priorities, policies, or programs.

Ontario Spotlight:
The Experimental Lakes Area

Source: http://upload.wikimedia.org/wikipedia/en/9/9d/Map_ont.jpg


Experimental Lakes Area
58 Small Lakes & their Drainage Basins
Minimal external human influences
Source: www.thecanadianencyclopedia.com



For more info on nutrient pollution at the experimental lakes area please see: http://www.experimentallakesarea.ca/images/Eutrophication.pdf

Video source: http://www.cbc.ca/player/News/Canada/Manitoba/ID/2364080390/

31

CBC news | Technology & Science

IN THE NEWS
- TIFF: Full coverage
- Canada's top 1%
- Intern hell
- Quebec charter

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Experimental Lakes Area to stay open with funding from Ontario, Manitoba

Ontario to spend $2M a year on research facility in northwestern Ont. to be run by Winnipeg-based International Institute for Sustainable Development

CBC News Posted: Sep 02, 2013 11:03 AM ET | Last Updated: Sep 03, 2013 1:40 PM ET

The Experimental Lakes Area has been the site of important research into lake ecosystems, climate effects and water pollution. (Handout/ Experimental Lakes Area/Canadian Press)

Facebook 0

Ontario will commit $2 million a year to keep the Experimental Lakes Area open, and Manitoba will contribute another $900,000 over six years

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Feds announce cash for Experimental Lakes Area

Fisheries and Oceans Canada to add $850K to existing $250K in annual funds for NW Ontario facility

By Bartley Kives, CBC News Posted: Aug 10, 2016 4:00 AM CT | Last Updated: Aug 10, 2016 2:38 PM CT

Freshwater scientists at the Experimental Lakes Area in northwestern Ontario have diverted water away from Lake 626 to see how increasing water clarity affects trout. The Trudeau government plans to announce funding for the ELA today. (Bartley Kives/CBC)

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The Trudeau government is spending $1.7 million over the next two years on environmental research at the Experimental Lakes Area, the northwestern Ontario scientific facility once threatened with closure by the former Harper government.

Kenora Liberal MP Bob Nault announced $850,000 in annual, short-term funding for the former federal facility, which Ottawa transferred in 2014 to the International Institute for Sustainable Development, a Winnipeg-based environmental policy think tank.

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http://www.cbc.ca/news/canada/manitoba/ela-federal-funding-1.3714301

Wicked Problems

The Northern Gateway Proposal

- Proposes to build a pipeline for Alberta extracted bitumen to reach the west coast
- Under heavy focus due to uncertain status of Keystone XL pipeline

FIGURE 1.1 | The routing of the proposed pipeline, showing crossing of Aboriginal territories and tanker routes.

Source: Unist'ot'en Camp, http://unistotencamp.com/wp-content/uploads/2009/03/energy_enbridge_pipeline_tanker_routes_yinkadene_feb2012.jpg.

The Northern Gateway Proposal, cont'd

- International ramifications:
  - Large increases in global CO_2 emissions → climate change
- National implications:
  - The scale of the project, trans-provincial issues, federal jurisdictions, global trade
- Provincial, regional, and local concerns:
  - Place-specific impacts of the infrastructure required
    - e.g. Haida Gwai islands
- Ethical issues:
  - Related to the rights of Aboriginal peoples and to whether we should be making a major contribution to furthering the negative impacts of the world's primary environmental problem

The Northern Gateway Proposal, cont'd

- The (previous) federal government strongly supported the project.
  - They saw the benefit to all Canadians and dismissed environmental concerns
- Scientists called for an assessment accounting for the cumulative effects of all the resource developments involved.
- Politically appointed federal panel dismissed the call for assessment.

The Northern Gateway Proposal, cont'd

- The BC government specified five requirements to be met before it would support the proposal:
  1. Completion of an environmental review process
  2. Proper marine oil spill response, prevention, and recovery system in place
  3. Proper land oil spill response, prevention, and recovery system in place
  4. Address Aboriginal rights and benefits
  5. BC receives its fair share of fiscal and economic benefits—reflecting the level of risk borne

The Northern Gateway Proposal, cont'd

- Federal government: established a National Energy Board panel in late 2009 to examine the Northern Gateway pipeline proposal and report before the end of 2013
- December 2013
  - The Enbridge Northern Gateway Project Joint Review Panel published a report
  - Recommended approval by the federal government of the proposed pipeline, subject to 209 conditions
- June 2014
  - The government of Canada accepts the independent Panel's recommendation to impose 209 conditions on Northern Gateway

The Northern Gateway Proposal, cont'd

- First Nations' leaders announced they would work collectively in "... a new push to halt the project through the courts, in public campaigns, and—if necessary—by protests on the land."

THE GLOBE AND MAIL

Court overturns Ottawa's approval of Northern Gateway pipeline

SHAWN MCCARTHY AND JEFF LEWIS
OTTAWA and CALGARY — The Globe and Mail
Published Thursday, Jun. 30, 2016 1:08PM EDT
Last updated Friday, Jul. 01, 2016 11:37AM EDT

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Enbridge Inc. and its oil industry partners have seen their faint hope for the Northern Gateway pipeline project dealt a major blow Thursday as the Federal Court of Appeal quashed the permit issued by the federal cabinet two years ago.

The three-justice panel concluded that the former Conservative government failed in its duty to consult First Nations prior to issuing a cabinet order approving the $7.9-billion pipeline that would deliver 525,000 barrels a day of oil sands crude to the West Coast for export to Pacific markets.

http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/federal-court-overturns-ottawas-approval-of-northern-gateway-pipeline/article30703563/

Wicked Problems

- Ill-defined, with incomplete and/or contradictory information or interpretations, many stakeholders with values in conflict, and an overall system and related issues which are uncertain and confusing.

Sustainable Development and Resilience

- Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

- Sustainable energy entails three strategic aspects:
  1. Presents a vision or direction of the nature of future societies
  2. Emphasizes a system of governance characterized by openness, transparency, decentralization, accessibility
  3. Ensures that economic, environmental, and social aspects are considered together and that trade-offs are visible and transparent

Sustainable Development and Resilience, cont'd

- The concept of sustainable development has generated both enthusiasm and frustration.
  - Provides a compelling vision for the twenty-first century that acknowledges the need to balance. social, economic, and environmental considerations
  - Term is so vague that it can be defined in ways to suit different and often conflicting interests.

Sustainable Development and Resilience, cont'd

- Resilience
  - The ability of a system to absorb disturbance and still retain its basic function and structure.
  - The ultimate goal is to move a system into some ideal state and sustain it in that state.
  - The more you optimize elements of a complex system of humans and nature for a specific goal, the more you diminish that system's resilience.

The Global Picture

- The sun provides an infinite supply of energy that could fuel a life support system that should provide perpetual sustenance for Earth's passengers.
  - However, organisms are going extinct at rates unsurpassed in last 65 million years.
  - The atmosphere is changing in composition, making climate change a reality.
- The Anthropocene
  - Dominant influence of humans on planetary processes.

The Global Picture, cont'd

- The Millennium Ecosystem Assessment
  - 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.
  - The experts concluded that many of the changes are non-linear and once they start, the processes of degradation will increase rapidly.

The Global Picture, cont'd

Population

- A key way that human life affects the planetary life support system is the number of passengers being supported (7.4 billion).
- Global energy consumption has risen sharply as the population has increased, as has pollution.
- 4.3 people are born every second worldwide, 80 million per year.
- With replacement-level fertility levels, the UN predicts over 10.9 billion people by 2100 .

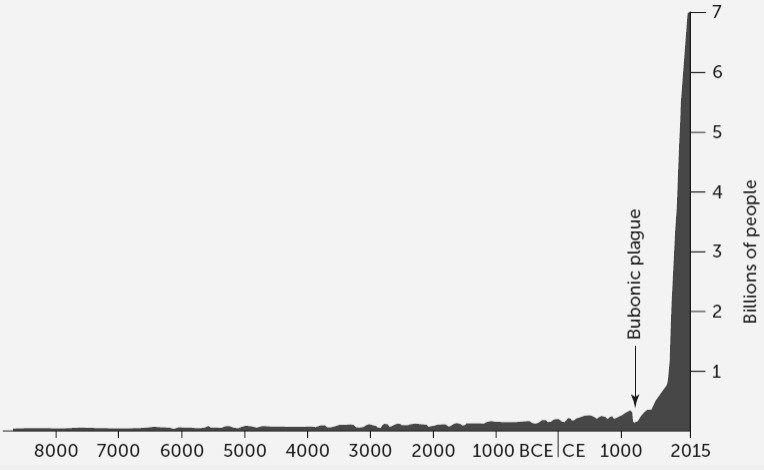


FIGURE 1.2 | The growth of human population over time.

Studying human populations

- Demographers study human populations, trends, growth and age structures
- Crude birth rate: number of births per 1,000 people per year
- Crude death rate: number of deaths per 1,000 people per year
- Crude growth rate: Crude birth rate – crude death rate
- Total fertility rate: average number of children per woman in a population
- Replacement fertility rate: 2.0

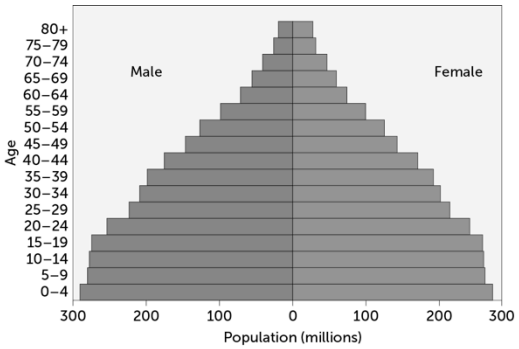
Growth via migration

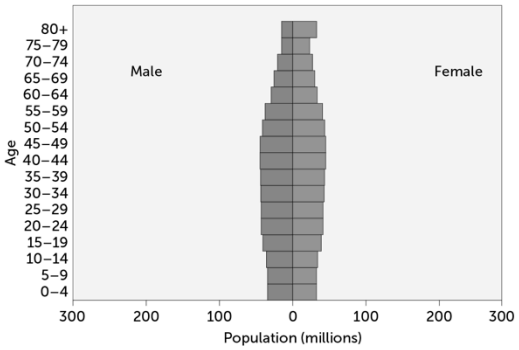
- Humans move or migrate between countries
- Countries like Canada grow through arrival of migrants
- Immigration is arrival of new people into a population
- Emigration is departure of people from a population

The Global Picture, cont'd

Population

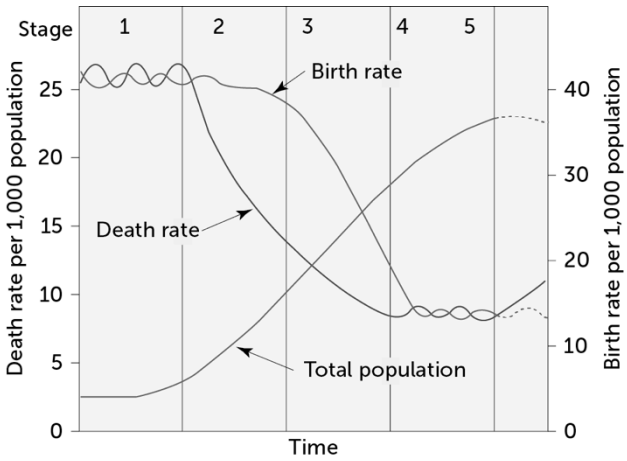
- Population age structure
  - If two countries have similar populations but differing age structures, they will have dramatically different future population growth





Demographic transition

- Change of populations over time from high birth rate to low birth rate and high death rate to low death rate.



The Global Picture, cont'd

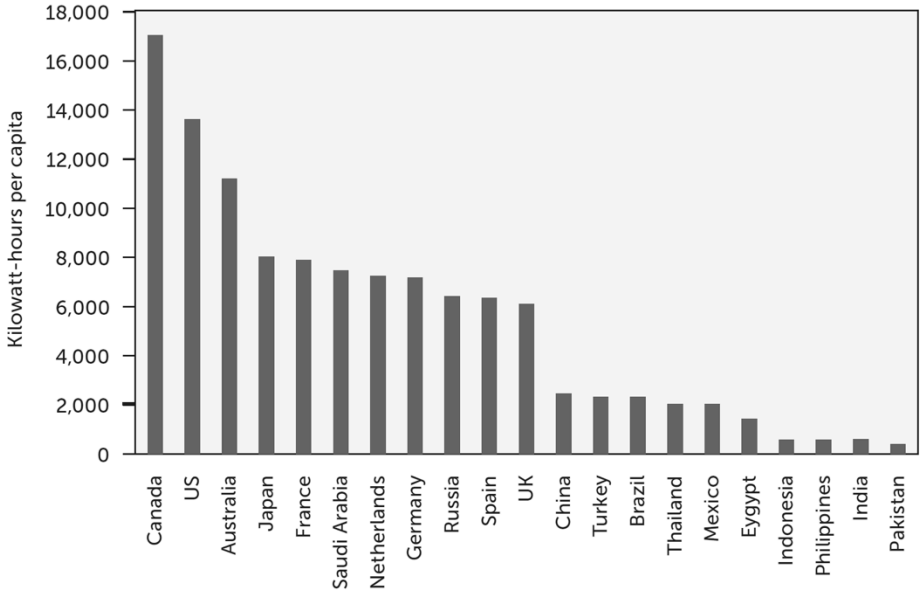
Consumption

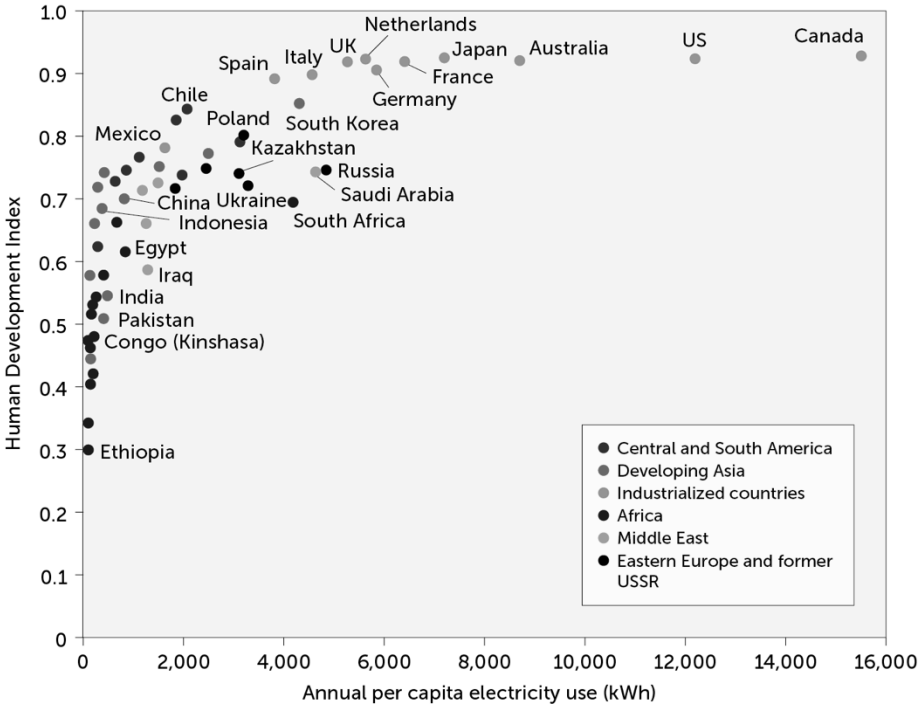
•Not all of Earth's passengers have the same impact on the life support system.

•The richest 20 per cent are responsible for more than 75 per cent of global consumption. The poorest 20 per cent consume less than 2 per cent.

•The wealthiest countries use 25 times more energy per capita than the poorest countries.

•Canadians are among the top per capita consumers of energy in the world.





The Global Picture, cont'd

Consumption

- Gross National Product (GNP)
  - Index used by economists to compare the market value of all goods and services produced in an economy in one year
  - A measure of economic success

- Global GNP rose by $47 trillion in the past twenty years
  - Only 15 per cent of this increase has trickled down to the (poorest) 80 per cent of the passengers

The Global Picture, cont'd

Nine Planets?

- The stresses on the planetary life-support system are a consequence of overconsumption and the resulting pollution, as well as overpopulation and the resulting poverty.
- Together, they create pressure on the planetary carrying capacity at many different scales.
- Nine main planetary processes need to be taken into account.

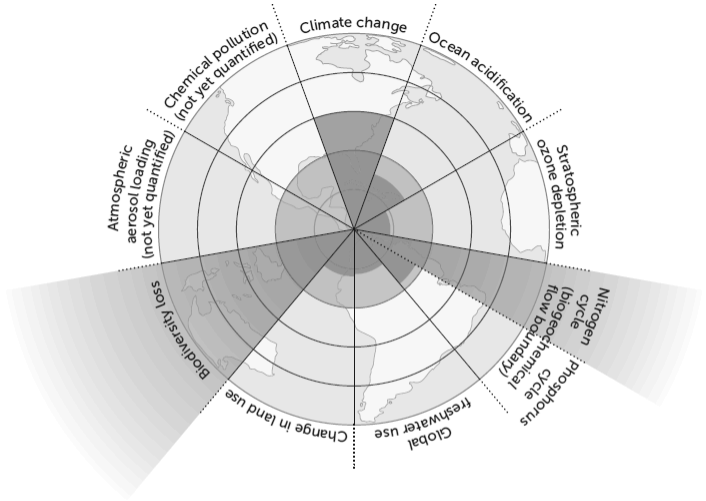


FIGURE 1.9 | Beyond the boundary. The inner green shading represents the proposed safe operating space for nine planetary systems. The red wedges represent an estimate of the current position for each variable. The boundaries in three systems (rate of biodiversity loss, climate change, and human interference with the nitrogen cycle) have already been exceeded.

Source: Rockström et al. (2009: 427). Copyright © 2009, Rights Managed by Nature Publishing Group

The Global Picture, cont'd

Nine Planets?

- Three of these system processes have already exceeded the safe operating zones:
  - Rate of biodiversity loss, climate change, and interference with the nitrogen cycle
- There is a need to set scientifically determined biophysical preconditions for human development and the need to stay within those boundaries.
- Violating these boundaries will result in a noted loss in the resilience of the Earth in its ability to produce the goods and services necessary to support humanity.

The Global Picture, cont'd

Nine Planets?

- Millennium Development Goals (MDGs) aim to improve human well-being:
  1. Eradicate extreme poverty and hunger
  2. Achieve universal primary education
  3. Promote greater gender equality
  4. Reduce child mortality
  5. Improve maternal health
  6. Combat HIV/AIDS, malaria, other diseases
  7. Ensure environmental sustainability
  8. Develop a global partnership for development

Jurisdictional Arrangements for Environmental Management in Canada

- Authority over, and responsibility for, natural resources in Canada is divided between the federal and provincial governments, with territorial and municipal governments. First Nations jurisdiction can intersect and overlap.

Jurisdictional Arrangements for Environmental Management in Canada, cont'd

Federal, Provincial, and Municipal Roles

•Control and ownership of Crown lands and natural resources is provincial; federal in the North.

•Legislative authority is mixed between federal and provincial governments.

•In the 1990s, many provincial governments began to download responsibilities onto municipalities to save costs, (principle of subsidiarity).

•Conservation authorities: provincial–municipal partnerships.

Measuring Progress

- Ecological footprints
  - Demands that humans place on nature in terms of supplying materials and disposing of wastes.
- DPSIR (Drivers-Pressures-State-Impact-Response) frameworks help to develop causal linkages between indicators.
- Indices are aggregates of similar indicators.
- The Living Planet Index—created by the World Wildlife Fund—quantifies the overall state of planetary ecosystems.
- Composite indices represent the highest levels of aggregation and are useful for decision-makers.

Implications

- We are violating global thresholds related to the carrying capacity of the life support system of the planet.
- The most important message underlying the environmental challenges we face is the need for fundamental changes in the way we view our relationship with nature.

To consider

- Try the environmental awareness quiz with your family and friends
- Do you think there is any difference based on age
- Do you think any other factors can affect environmental awareness?

Next class

- Bring either your registered i>clicker device or a registered REEF app on one of your devices!