



Introduction to Environmental Science

Dr. Tareq Abu Hamed

Dr. Noah Morris

3 weekly lecture hours, 3 credits. Undergraduate

Course description

This course is designed to give an overview of environmental science, focusing on global environmental issues. The course will look at past and present environmental issues and the chemical, physical and statistical tools that assist in the study of the environment.

The course will cover the major environmental issues facing our planet:

Air pollution,

Population growth

Energy resources

The water cycle

Global warming

Hazardous substances

Ozone depletion

Grade components

Grading

Class participation	10%
Quizzes	12%
Chemical of the Session	3 %
Paper	30%
Midterm	15%
Final exam	30%

Textbook for the course:

Chapters in: "Environmental Science" by Richard T. Wright, International Edition (9th)
Pearson-Prentice Hall (2005)

Class 1 Our planet – Toward a Sustainable Future

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". (The Brundtland Report 1987)

Definitions of sustainability

Natural and anthropogenic processes

How can sustainability be measured in terms of population, pollution, energy resources etc.?

Numbers tell stories

*Readings: "Environmental Science" by Richard T. Wright, International Edition (9th)
Pearson-Prentice Hall (2005), pages 1-21 and appendix C, pages 669-675.*

A. Shi. The impact of population pressure on global carbon dioxide emissions, 1975–1996: evidence from pooled cross-country data. *Ecological Economics, Volume 44, Issue 1, 2003, Pages 29-42.*

E.L. Sundblad, A. Biel, T. Gärling. Intention to change activities that reduce carbon dioxide emissions related to worry about global climate change consequences. *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology, 64(1):13–17, 2014*

<https://www.gapminder.org>

Discussion: Is sustainability achievable?

Discussion: Is there a conflict between achieving sustainability and promoting human well being (poverty reduction)?

Class 2 Population and Development

"The battle to feed all of humanity is over. In the 1970s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date nothing can prevent a substantial increase in the world death rate..."(The Population Bomb by Paul Ehrlich - 1968)

The world population from the year 1000 till 2100

What has caused the "population explosion"?

Exponential Growth

Rich Nations / Poor nations / Israel (a special case?)

The demographic transition

Predictions and confidence intervals

Resources:

United Nations, Population Division (2017). *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables.*

"Environmental Science" by Richard T. Wright, International Edition (9th) Pearson-Prentice Hall (2005), pages 123 – 177.

BBC Podcast: "Should we have smaller families?", www.bbc.co.uk/radio/play/b093stg6

Discussion: How should we plan for 11 billion people in 2100?

What are the most effective ways to reduce population growth?

Class 3 Matter and Energy

*"Matter is dead weight
Energy prompts it to move
The world animates" (C.P. Sharma)*

Four types of matter – Solid, Liquid, Gas and Plasma.

Chemical and physical tools assisting environmental studies - the atomic structure, chemical bonding and chemical reactions

Different types of energy – Potential, Kinetic, Heat

Solar energy and Photosynthesis.

Measuring the efficiency of energy conversion?

Readings: "Environmental Science" by Richard T. Wright, International Edition (9th) Pearson-Prentice Hall (2005), pages 55-83.

Classes 4 and 5 Atmospheric Pollution

"It is better to have your head in the clouds, and know where you are... than to breathe the clearer atmosphere below them, and think that you are in paradise". (Henry David Thoreau)

The greenhouse effect and global warming

Acid rain phenomenon

The hole in the ozone layer (chlorofluorocarbons)

Chemical reactions in the atmosphere and the environmental impacts of fossil fuels.

Meteorological data - world trends and local trends

The hockey stick graph - temperature trends and predictions

Rainfall trends and predictions

CO2 emissions and temperature – correlation and causation.

Identifying, trend, seasonality and noise in meteorological data,

Data analysis concerning global warming. What is the question to be answered? What stories do the numbers tell?

Readings: "Environmental Science" by Richard T. Wright, International Edition (9th) Pearson-Prentice Hall (2005), pages 538-570,

D. Fowler, N. Dise and L. Sheppard. Committee on air pollution effects research: 40 years of UK air pollution. Environmental Pollution. 208, 2016, Pages 876-878

David Appel (2015). Behind the Hockey Stick, Scientific American, 292(3): 34-35.

Discussion – How should we prepare for global warming?

– Prediction - what will happen to the climate by 2045? How certain/uncertain are we?

Class 6 Mid term

Class 7 Energy

"I think the cost of energy will come down when we make this transition to renewable energy". (Al Gore)

The world's energy use and resources

An introduction to renewable energy sources.

Data about trends in energy – the use and misuse of graphs

Readings: "Environmental Science" by Richard T. Wright, International Edition (9th) Pearson-Prentice Hall (2005), pages 323-347

L. White (2015). Energy production: Is short-termism damaging our planet? Renewable Energy Focus. Volume 15, issues 5-6, Pages 120-123

Discussion: What are the costs of renewable energy.

Is it legitimate to misuse a graph for a good cause?

Class 8 The Water Cycle and Water Pollution

"We forget that the water cycle and the life cycle are one". (Jacques Yves Cousteau)

The water cycle, the liquid state of matter, properties of water, types of solutions; the pH concept.

Waste water treatment
Chemical pollutants.
Data on the use of recycled water
How much water do humans use (by type of use, by region)?
A case study – aquifers in the Southern Arava
A case study – how use of data affected policy – Flint USA.
When to use of p-values and significance tests.

Readings: “Environmental Science” by Richard T. Wright, International Edition (9th)
Pearson-Prentice Hall (2005), pages 177-205, 462-489.

O. Kfir, A. Tal, A. Gross, E. Adar. The effect of reservoir operational features on recycled wastewater quality. *Resources, Conservation and Recycling, Volume 68, 2012, Pages 76-87.*

Hanna-Attisha M (2018). *What the Eyes Don't See: A Story of Crisis, Resistance and Hope in an American City.* One World publishers

Class 9 Field Trip

Some or all of the following places:

- Recycling centre - Eilat
- Sewage plant – Eilat
- Land fill - Nimra
- Meteorological Station - Yotvata

Class 10 Solid Waste

“My senior project was about solid-waste management. They nicknamed me “Trash Queen” (Marne Levine)

Solid waste, hazardous waste, other types of wastes
Data on waste disposal on a world wide scale and on a local scale (the Southern Arava)
the use of central values and measurements of variability.

Readings: “Environmental Science” by Richard T. Wright, International Edition (9th)
Pearson-Prentice Hall (2005), pages 490 – 511.

S.M. Al-Salem, P. Lettieri, J. Baeyens (2009). *Recycling and recovery routes of plastic solid waste (PSW): A review.* Waste Management, Volume 29, Pages 2625-2643.

H. Chan (2010). *Removal and recycling of pollutants from Hong Kong restaurant wastewaters.* Bioresource Technology, Volume 101, Issue 17, Pages 6859-6867

Discussion – How effective is recycling?

Class 11 Toxicology

“Pollution is the largest cause of disease and premature death in the world today. Diseases caused by pollution were responsible for an estimated 9 million premature deaths in 2015” (The Lancet)

What is toxicity? Analysis of several natural and industrial processes, hazardous substances, whole life cycle analysis.

Measuring the affects of toxicity – false positives, false negatives and p-values.
Critical reading of data in articles (The Lancet v Breitbart News).

Readings: “Environmental Science” by Richard T. Wright, International Edition (9th)
Pearson-Prentice Hall (2005), pages 404-431

Mehrdad Farhadian, Cédric Vachelard, David Duchez, Christian Larroche (2008). *In Situ bioremediation of monoaromatic pollutants in ground water: A review*. *Bioresource Technology*, Volume 99, Issue 13, Pages 5296-5308.

Readings: The Lancet (2017). *Commission on Pollution and Health* (Published online 19th October, 2017 [http://dx.doi.org/10.1016/S0140-6736\(17\)32345-0](http://dx.doi.org/10.1016/S0140-6736(17)32345-0))

Breitbart News (2017). *Lancet: Pollution, Not CO2, Is 'Largest Environmental Cause of Disease and Death'* (Published 20th October, 2017)

Discussion: Toxicity of VOC

Class 12 Presentation of student's projects and review

Class 13 Presentation of student's projects and review

Recommended Reading:

“Human Geography” by Paul L. Knox And Sallie A. Marston, 3rd Edition
Pearson-Prentice Hall (2004).

Will the Circle Be Unbroken: A History of the U.S. National Ambient Air Quality Standards.

John Bachmann, *Journal of the Air & Waste Management Association*, volume 57, pp 652-697 (2007).

Sustainable Development, Global Environmental Change and Public Health. A.J .McMicheal and T. Kjellstrom. Fall, Automne 2002.

Health and Sustainable Development World Summit on Sustainable Development. International Institute for Environmental and Development. . David Bradley, Sandy Cairncross and Carolyn Stephens. May 2001.

Chemical and physical tools assisting environmental studies - the atomic structure, chemical bonding and chemical reactions

Lecturer: Dr. Tareq Abu Hamed

S.M. Al-Salem, P. Lettieri, J. Baeyens. Recycling and recovery routes of plastic solid waste (PSW): A review. *Waste Management, Volume 29, Issue 10, October 2009, Pages 2625-2643*

H. Chan. Removal and recycling of pollutants from Hong Kong restaurant wastewaters *Bioresource Technology, Volume 101, Issue 17, 2010, Pages 6859-6867*