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The Environment and Health

Learning Objectives

In this chapter, you will learn to

- Understand that the health effects of environmental factors may be substantially modified, either negatively through poor planning and weak regulation, or positively through effective public policy and collaborative action;
- Appreciate how environmental variables interact with biologic ones to affect health outcomes;
- Reflect on the interactions among economic activity, government regulation, and the health of populations.

Chapter Overview

The chapter begins with an overview of climate change and shows what effects the climate change had already had on the environment and how these effects can impact the health of individuals. In particular, the spread of communicable diseases—West Nile virus, Lyme disease, and some others—can be linked to climate change.

Next, the author discusses natural disasters and shows that less well-off people are more likely to be affected by floods and hurricanes and are also less likely recover from them.

The author reviews how the modern food production—farming of plants, animals, and fish—impacts the environment and causes spread of new communicable diseases. New, deadlier viruses are transmitted from animals to humans due to large-scale food production.

Next, the author discusses air pollution and reviews the negative impacts of lead, mercury, and arsenic that are often used in urban environment infrastructure. The household environment is also a potential threat to human health. Plastics also have a serious negative impact on the environment. Fortunately, there is much that can be done at the government level to offset the negative implications of climate change on health.

Key Terms and Concepts

Acidification a lowering of the pH of the oceans, as carbon dioxide converts to carbonic acid (p. 290)

BSE (bovine spongiform encephalopathy) a disease that affected British and Canadian beef cattle that arose through the factory farming practice of increasing the protein content of artificial animal feeds through adding slaughterhouse waste (p. 296)

Cumulative risks the type of risk where each additional exposure multiplies the risk of an adverse health outcome (p. 300)

Dead zones areas in the oceans created by the agricultural pollution via run-off into rivers (p. 297)

Fuel insecurity when people cannot afford electricity or gas bills for heating (p. 300)

Greenhouse gases gases that trap the heat from the sun in the atmosphere, such as carbon dioxide or methane (p. 289)

Mad Cow disease a brain wasting disease BSE (p. 295)

Monocropping the practice of planting vast areas with only one variety of plant (p. 295)

SARS Severe acute respiratory syndrome that arose from the factory farming of ducks (p. 296)

Swine and avian influenzas influenza viruses that originated in pigs or birds and were transmitted to humans (p. 294)

Study Questions

Scroll down for answers.

1. Summarize the changes that occur in the world due to changes in the temperature of the land and sea.
2. Explain how factory farming can influence our health
3. Describe the potential implications of fish factory farming
4. Outline the potential dangers of plastic.

Critical Thinking Questions

Scroll down for answers.

1. Outline the implications of climate change on the health of individuals
2. Explain why less well-off people are more affected by climate change.
3. Explain the link between air pollution and health.

Annotated Multimedia Resources

1. Plastic Ocean
https://www.youtube.com/watch?v=ju_2NuK5O-E (7:28 min)
This video that was produced by the United Nation, shows that the durability of plastic presents serious risks for ocean life and our planet.
2. Drowning in plastic – BBC documentary
<https://www.youtube.com/watch?v=1U7jVMlrKHK> (5:39 min)
This BBC documentary summarizes the impact of plastic on the environment.
3. Trudeau defends carbon tax plan: “Climate change is real”
<https://www.youtube.com/watch?v=-PJhMiRnNsQ> (5:47 min)
The CTV news shows a townhall meeting with Prime Minister Trudeau where he explains that climate change is real.
4. A History of Earth’s Climate
https://www.youtube.com/watch?v=dC_2WXyORGA (11:19 min)
This SciShow video takes a historical view on the Earth’s climate changes.
5. Climate Change, Natural Disasters and the Urban Poor
<https://www.youtube.com/watch?v=8aex529RpE> (5:00 min)
This short World Bank documentary shows the impact of climate change on natural disasters and, consequently, on worlds’ poor populations.
6. How to transform apocalypse fatigue into action on global warming?
https://www.ted.com/talks/per_espen_stoknes_how_to_transform_apocalypse_fatigue_into_action_on_global_warming#t-25200 (13:31 min)
In this TED Talk, psychologist Per Espen Stoknes suggests a novel approach to talk about climate change that he believes would be more efficient in fighting climate change.
7. The other inconvenient truth
https://www.ted.com/talks/jonathan_foley_the_other_inconvenient_truth?language=en (16:55 min)
In this TEDX Talk, Jonathan Foley shows the impact of farming on our planet.
8. Romaine lettuce *E. coli* outbreak spreads
<https://www.youtube.com/watch?v=Wem9r0G55Wg> (3:37 min)
A CBC news report on the e-coli outbreak in November 2018. The impact of the outbreak is reviewed in this report.

Answers to Study Questions

1. Over the past century, the average temperature of the land and sea has risen about one degree, with the rate of change roughly doubling since 1950. This is a clear trend and not a feature of climate variation. The rate of warming is accelerating, and even if the world achieves strict controls on CO₂ emissions from vehicles, power plants, aircraft, heating residential and commercial buildings, and industrial processes, average temperatures are expected to rise another two degrees in the next few decades. The temperature changes are not uniform. The northern polar region has seen the greatest and most sustained increase in temperature, as well as warming polar seas and melting Greenland glaciers and sea ice. Warming has had, partly in consequence of the effects in the Arctic, an enormous impact on the oceans, raising sea levels and decreasing ocean salinity. That, in turn, affects the ecology of the oceans, making the seas much less hospitable to marine life, and forcing the migration of colder-water fish farther and farther north. Ocean temperature change also affects the weather, by altering the El Niño and La Niña cyclical weather events that bring precipitation or drought to the western Americas; changing the predictability, timing, and intensity of the monsoons in Asia and Africa; and creating conditions for tropical storms and hurricanes. Higher sea levels threaten low-lying land, much of it heavily populated, with flooding. Higher sea levels also mean the infiltration of salt into low-lying agricultural land, contaminating the soil and groundwater, making growing food and obtaining irrigation and drinking water difficult. (p. 291)
2. Intensive farming by large-scale commercial agro-business is associated with widespread pollution, and the production of novel pathogens, particularly swine and avian influenzas, but also the brain wasting disease BSE (“mad cow” disease). It is also associated with elevated risks of human infections of *E. coli*, listeriosis, and salmonella. Intensive cropping of corn and soya beans requires extensive irrigation. Irrigation degrades the soil and, over time, increases its alkalinity and reduces its capacity to nourish plants, leading again to increased application of chemicals to the land. The enormous US surpluses of corn and soy encourage their use as animal feeds, which makes possible the factory farming of chickens, pigs, and cattle. Corn and soy do not form part of the natural diet of any of these farmed animals, raising concerns not only about the health of the animals, but also about the health-relevant properties of the animal-derived food products. Some epidemiologic studies claim that European dairy products are quite different from, and healthier than, North American ones because milk cows in North America are fed a variety of grains and manufactured feeds as opposed to the primarily grass diet used in Europe. Factory farming of animals, from cattle feed lots, to sheds housing thousands of pigs, to factories housing tens of thousands of chickens, produces a prodigious amount of animal excrement. Mostly, it is liquefied and then spread on agricultural land as fertilizer. Heavy spreading of manure on the land raises the risk of produce becoming contaminated with potentially deadly e-coli bacteria (p. 295–296)
3. Factory farming of fish, widespread on the Canadian Pacific coast, generates massive amounts of waste that is toxic to natural marine life. It also has been implicated in the transmission of disease from the penned farmed fish to wild fish stocks. Moreover, the fish are fed artificial food and then fed other chemicals to change their flesh colour, grey, to the bright red consumers expect. In August 2017, as many as 300,000 farmed salmon escaped their containment nets in the Pacific Ocean. They are an alien species to the Pacific (being Atlantic rather than Pacific salmon) and no one has any idea what environmental impact this foreign population might have on wild fish. (p. 296)

4. Plastics of all kinds are ubiquitous in the environment. They don't decompose but instead fragment into smaller and smaller pieces. Micro-particles of plastic and strands of plastic fiber are readily incorporated into living things, from plants to people. Plastics are toxic, and many kinds of plastic are hormone disruptors. Moreover, the surfaces of plastic micro-particles accumulate other environmental toxins (which adhere to them), and serve as growing media for pathogenic bacteria. Those micro-particles are now incorporated into the tissues of algae, plankton, and hence shellfish and fish further up the food chain, and have found their way into the cells of terrestrial animals, including humans. The seas, lakes and rivers, and the atmosphere are all heavily contaminated with plastic particles and fibers. Discarded plastic items, from bags, to disposable diapers, to toothbrushes, to water bottles and pop containers are sources of some particles. Others come from more surprising sources, such as micro-beads of plastic that were widely used in cosmetics until banned in 2016, clothing, and sewage sludge, one-half of which is removed from treatment plants and spread on the land, despite being heavily contaminated with plastic particles (from sources such as laundry), human pharmaceuticals, and heavy metals. Tiny particles of plastic are rubbed off vehicle tires as they roll down roads, particles that then get blown into the air or washed into rivers, lakes, and oceans. It was discovered that plastic micro-particles and fibres contaminate drinking water. The effects on human health are also, as of yet, unknown, but they certainly are not good. Brain neurons, in particular, are highly vulnerable to damage from micro-particles of all kinds crossing the cell wall. (pp. 299–300)

Answers to Critical Thinking Questions

1. The implications include decrease in availability and affordability of food, lack of secure housing, changes in agricultural practices and marine life which all affect food supply and economy. In addition, climate change leads to the spread of communicable diseases and increased social and economic inequalities (pp. 290–291).
2. Disasters such as earthquakes, hurricanes, flooding events, and landslides are natural, environmental phenomena, although human changes to the landscape can change their frequency and severity. Less well-off people are disproportionately harmed by such catastrophes because of where they live. Low-quality housing is subject to collapse in heavy winds or when stressed by the forces of an earthquake. Poorer neighbourhoods are situated either in low-lying land (a common situation in North America) or (in the case of developing countries) on steep slopes avoided by property developers because of the expense of installing infrastructure, as well as safety concerns about stability. The former, low-lying neighbourhoods, are inundated by heavy rains; the latter, hillside shantytowns, are crushed by mudslides. Low-lying, mostly poor, neighbourhoods in cities like Houston and New Orleans lack storm drainage systems that can deal with rain events, in spite of the fact that such events are commonplace on the Gulf of Mexico. Some neighbourhoods are below sea level, even though they are close to the ocean and therefore susceptible not only to flooding by rain but also to tidal surges. When major weather events are predicted, affluent people have the ability to stock up on provisions and buy portable electric generators. They have cars and can purchase extra fuel to ensure they can leave if the situation becomes threatening. They also have friends, with whom they can stay, in neighbourhoods safe from the pending disaster. Additionally, better-off people have adequate cash and credit to relocate temporarily to hotels. Poor people have none of these things. They lack private transportation and accommodation options, have no ready cash or credit, and cannot take time away from their low-wage jobs, first because they can't afford to, and second because it's likely they would

be fired. Moreover, homes in poor neighbourhoods are more likely to be looted if the residents evacuate, and those homes are less likely than the homes in more affluent areas to receive adequate protection from emergency officials. Consequently, in the event of an expected disaster, it is poorer people who disproportionately remain in their homes, and those homes are disproportionately prone to the worst effects of that disaster. (pp. 291–292)

3. Air pollution in Canada contributes to 7700 avoidable deaths each year. The main sources are electricity generation in coal- and oil-fired plants, motor vehicles, and emissions from domestic and factory heating. Especially dangerous are fine particles (2.5 microns or smaller) from vehicle emissions and coal and wood smoke, which not only are drawn very deeply into the lung, but migrate from the lung into the bloodstream. Consequently, beyond irritating the respiratory tract, fine particulates have systemic health effects. Gaseous emissions such as carbon monoxide, nitrous oxide, and sulfur dioxide are highly toxic. Tetraethyl lead additives, introduced into gasoline supplies by the major oil companies from the 1920s in order to boost the octane of low-quality gasoline and to provide extra lubrication to valves and rings in engines, was not phased out entirely until 1996, despite it having been known from before its use began that the lead emissions were toxic. Tens of thousands of children suffered needless neurological damage from lead pollution in the atmosphere. Especially hard hit were poor children whose homes tended to be close to busy roads and freeways. (p. 297)