CPH601 Chapter 11 Transboundary Health/Global Health

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Available at: https://works.bepress.com/david_mannino/72/
TRANSBOUNDARY AND GLOBAL HEALTH ISSUES

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GLOBAL HEALTH CONCERNS

- Disasters
  - Natural and Technological Disasters
  - War
- Transboundary and Global Environmental Issues
  - Ozone Depletion and Ultraviolet Radiation
  - Climate Change and the Greenhouse Effect
  - Deforestation and Desertification
  - Biodiversity
  - Acid Deposition
  - Waste Management
- Global Chemical Contamination
- Emerging & Re-emerging Health Issues
Immediate injuries and acute illnesses
Prolonged health issues, e.g. mental health issues
Damaged infrastructures providing essential human needs, e.g. water, food, shelter, etc.
Economic and social losses

## Table 11.3

<table>
<thead>
<tr>
<th>Perceived Differences Between Natural and Technological Disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature of disaster</strong></td>
</tr>
<tr>
<td>Clean, unavoidable</td>
</tr>
<tr>
<td><strong>Responsibility</strong></td>
</tr>
<tr>
<td><strong>Objective magnitude of loss</strong></td>
</tr>
<tr>
<td><strong>Perceived magnitude of loss</strong></td>
</tr>
<tr>
<td><strong>Community support for those affected</strong></td>
</tr>
</tbody>
</table>
Or Manmade?

Much of the increase in the number of hazardous events reported is probably due to significant improvements in information access and also to population growth, but the number of floods and cyclones being reported is still rising compared to earthquakes. How, we must ask, is global warming affecting the frequency of natural hazards?

Emmanuelle Bournay, UNEP/GRID-Arendal

http://www.grida.no/graphicslib/detail/trends-in-natural-disasters_a899#
TECHNOLOGICAL/MANMADE DISASTER
The approach to warfare had changed
- More civilian targets
- Destruction of food source and shelter
- Disrupt economy and civil society
- Drones?

**Table 11.1**

<table>
<thead>
<tr>
<th>Century</th>
<th>Average Annual Military Deaths</th>
<th>World Mid-Century Population in Millions</th>
<th>Average Annual Military Deaths per Million Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>17th</td>
<td>9500</td>
<td>500</td>
<td>19.0</td>
</tr>
<tr>
<td>18th</td>
<td>15,000</td>
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<td>19th</td>
<td>13,000</td>
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<tr>
<td>20th</td>
<td>458,000</td>
<td>2500</td>
<td>183.2</td>
</tr>
</tbody>
</table>

HEALTH TRAGEDY

- The dead and those left behind
- Displacement/refugees
  - Crowding and over-population
  - Often un-met basic needs, e.g. water, sanitation, food, shelter
  - Easy spread of communicable diseases
  - Shortage on health care, education, and other civilian needs
- Those who return home
  - Injury
  - Communicable diseases/pathogens
  - Mental Health Problems/PTSD
GULF WAR SYNDROME

Real problems
Gulf-war veterans’ illnesses, 2005
% above national average

- United States
- Australia
- Britain
- Denmark

- Memory problems
- Fatigue
- Skin condition
- Muscle/joint pain
- Headache
- Post-traumatic stress disorder

Source: US Department of Veterans Affairs
Models of chemical exposure were developed using data supplied by NRL from the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS). COAMPS, which generates high resolution numerical models of the atmosphere, is an analysis-nowcast and forecast tool applicable for any given region of the earth.
Controlled release of toxic chemicals or pathogens
- Unit 731, a notorious Japanese covert biological and chemical warfare research and development unit
- Iran-Iraq War, *Halabja poison gas attack* killing about 5,000 of the town's 50,000 residents
- U.S. Army Biological Warfare Laboratories (1943-69): 3 deaths related to occupational bio-agent exposures
- Biopreparat: Soviet Union's major biological warfare agency from the 1970s on

- Both outlawed
- Both could be used by terrorists
WAR: NUCLEAR

- Massive destruction of people and region
- Radiation
  - Long term exposure
  - Transportation of radioactive materials
- Hiroshima and Nagasaki

Mushroom cloud from the atomic explosion over Nagasaki rising 60,000 feet into the air on the morning of August 9, 1945.

WAR: GUERRILLA, TERRORISM, & DELIBERATE ENVIRONMENTAL DESTRUCTION

- Guerrilla warfare
  - attacks periodically and without warning
- Environmental destruction
  - an escalation from Guerrilla warfare
- Terrorism
  - Subway Sarin Incident, 1995
  - 911, 2001
  - Bali bombing, 2002
  - London underground bombing, 2005
GLOBAL ENVIRONMENTAL ISSUES

- Ozone Depletion and Ultraviolet Radiation
- Climate Change and the Greenhouse Effect
- Deforestation and Desertification
- Biodiversity
- Acid Deposition
- Waste Management
OZONE DEPLETION & UV RADIATION

- Effects on Human Health
  - Skin Cancer
  - Immune System - may enhance risk of infection

- Aquatic Ecosystem
  - Loss of phytoplankton

- Terrestrial Ecosystem
  - Animals
  - Plants

- Air Pollution
  - increase ground-level ozone

OZONE DEPLETION & UV RADIATION

Annual mean tropospheric CFC-11, CFC-12, CFC-113, carbon tetrachloride (CCl₄) and sulfur hexafluoride (SF₆) concentrations in the northern (NH) and southern (SH) hemispheres for the period 1910 to 2011

Data from: http://cdiac.ornl.gov/oceans/new_atmCFC.html

Figure 2. Age-adjusted melanoma mortality rates by race and gender, 1969–1998.
(Source: National Center for Health Statistics, CDC)

1. Graph from http://ozonewatch.gsfc.nasa.gov/
Heat balance

http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/fig1-2.htm
CLIMATE CHANGE & GREENHOUSE EFFECT

- Carbon Cycle

Figure 11.6 The carbon cycle. From McMichael, 1993, with permission.
Global Temperature

Global Temperatures

- 5 year average
- Annual average

Global Temperatures for the past 425,000 years

Temperature variation from the 1661-1990 average (°C)

Northern Hemisphere

- Proxy data
- Thermometers used

Graphs showing temperature anomalies and variations over time.
Sea ice Extent

The area pictured extends from the coast of Alaska in the lower left across the Beaufort Sea to the islands of northern Canada.

Fracture of Arctic Sea Ice
- The area pictured extends from the coast of Alaska in the lower left across the Beaufort Sea to the islands of northern Canada.

Climate Change

Regional weather changes:
- Heatwaves
- Extreme weather
- Temperature
- Precipitation

Modulating influences

Health effects:
- Temperature-related illness and death
- Extreme weather-related health effects
- Air pollution-related health effects
- Water and food-borne diseases
- Vector-borne and rodent-borne diseases
- Effects of food and water shortages
- Mental, nutritional, infectious and other health effects

Research needs

Health-specific adaptation measures

Evaluation of adaptation
Forest can
- Remove and store carbon
- Hold water and soil
- Preserve bio-diversity

Figure 1. Area of virgin forest. Top to bottom 1620, 1850, and 1920 as published by William B. Greeley, "The Relation of Geography to Timber Supply," Economic Geography, vol. 1, pp 1-11 (1925). The depiction of U.S. forests in the later maps may be misleading in that they show only old-growth forest and no total tree cover.
The darker bars represent the actual area of the Brazilian portion of the Amazon deforested each year between 1990 and 2009 (figures on left vertical axis), as observed from satellite images analysed by the National Space Research Agency (INPE). The lighter bars represent the projected average annual rate required to fulfill the Brazilian government target to reduce deforestation by 80% by 2020 (from the average between 1996 and 2005). The solid line shows cumulative total deforestation (figures on right vertical axis) as a percentage of the estimated original extent of the Brazilian Amazon (4.1 million km²).

Source: Brazilian National Space Research Agency (INPE)
Forest as a complicated ecosystem
- tree-dominated
- plants, animals, and microorganisms interact with each other
- also abiotic components e.g. soil, water, climate
- the more complicated an ecosystem is, the more stable it is, but the harder the recovery would be

When trees are cut down:
- long recovery time
- bare soil become deserted, or washed into waterway
- habitat loss and species die off
- even with re-forestation, it would be a much more simple and un-stable ecosystem which is more vulnerable to human activities
“the process of fertile land transforming into desert typically as a result of deforestation, drought or improper/inappropriate agriculture”

- approximately 40-41% of Earth’s land area is drylands (vulnerable to desertification)
- home to more than 2 billion people
- estimations:
  - some 10-20% of drylands are already degraded
  - total area affected by desertification being between 6 and 12 million km²
  - about 1-6% of the inhabitants of drylands live in desertified areas,
  - a billion people are under threat from further desertification

**Source:** Adapted from Medugu (2007)
Biodiversity

- Genetic diversity
- Ecosystem diversity
- Crop diversity
  - Monoculture: vulnerable to pests & diseases
- Natural chemical diversity
  - Medical research
  - Bioprospecting, e.g. herbal remedies
- Sources for bio-technology/genetic engineering
  - Ironically, genetic engineering accelerate monocultures
Biodiversity Crisis

Causes:
- over-hunting/fishing
- Loss of habitat or food sources
- Change of environments
  - urbanization
  - agricultural clearance
- Invasive species

Not only loss in species numbers but also loss in the variation within species

Biodiversity is an important indication of the degradation of an ecosystem
- even when the ecosystem “looked” ok

Two essential factors of a stable ecosystem:
- complexity & variation
What is a tipping point?

- **Threshold**
- **Time lag**
- **Self-perpetuating**
- **Long lasting/hard to reverse**

**SAFE OPERATING SPACE**

**CHANGED STATE**

- Less diverse
- Fewer ecosystem services
- Degradation of human well-being

Source: Global Biodiversity Outlook 3
Since the mid-1990s, China’s Marine Trophic Index has shown signs of an increase. This follows a steep decline during the 1980s and early 1990s, resulting from overfishing. The figures suggest that although the marine food web off China may be recovering to some extent, it has not returned to its former condition.

Source: Chinese Ministry of Environmental Protection
Large numbers of breeds of the five major species of livestock are at risk from extinction. More generally, among 35 domesticated species, more than one-fifth of livestock breeds, are classified as being at risk of extinction. Source: FAO
The global Living Planet Index (LPI), has declined by more than 30% since 1970,

The Tropical LPI has declined by almost 60%.

The Temperate LPI showed an increase of 15%, reflecting the recovery of some species populations in temperate regions.

Source: WWF/ZSL

Source: Global Biodiversity Outlook 3
The Red List Index tracks the percentage of fully-assessed species groups expected to survive into the future:

- whether the risk of extinction is increasing or decreasing over time

The Red List Index (RLI) for all these species groups is decreasing.

- Coral species are moving most rapidly towards greater extinction risk

- Amphibians are, on average, the group most threatened.

Source: IUCN
Source: Global Biodiversity Outlook 3
Acidic chemicals
- Mainly sulfates & nitrates
- Transformed into dry or moist secondary pollutants such as $\text{H}_2\text{SO}_4$, $\text{NH}_4\text{NO}_3$ and $\text{HNO}_3$

Very long distance from the emission of pollutants

Wet deposition
- acid rain, snow, sleet or hail
- pH normally below 5.6 are removed

Dry deposition
- Sulfates, nitrates, and gases (such as $\text{SO}_2$ and $\text{NO}_x$) are deposited on, or absorbed onto, surfaces of particles such as fly ash
- The gases can then be converted into acids when they contact water
- Also relates to ground-level Ozone
ACID DEPOSITION

- Affect soil and thus plants and crops
  - Reduced acid neutralizing capacity in soil
- Affect water and thus aquatic lifes
- Direct effects on plants and animals
- Affect historic structures

Picture Source: “Chemistry of Acid Rain” http://2012books.lardbucket.org/books/general-chemistry-principles-patterns-and-applications-v1.0/section_08_07.html
Control Measure
- Reduce Emissions
2006 Total Waste Generation—251 Million Tons (before recycling)

- Paper 33.9%
- Yard Trimmings 12.9%
- Food Scraps 12.4%
- Plastics 11.7%
- Metals 7.6%
- Rubber, Leather, and Textiles 7.3%
- Glass 5.3%
- Wood 5.5%
- Other 3.3%
DECREASING LANDFILL AVAILABILITY

![Graph showing decreasing landfill availability from 1988 to 2005. The y-axis represents the number of landfill sites available, and the x-axis represents the years from 1988 to 2005. The graph shows a significant decrease in the number of available landfill sites over time.](image-url)
Solid Waste Management Hierarchy

Source Reduction
Reuse
Recycling
Resource Recovery
Incineration
Landfilling
Waste Disposal

Most Preferred
Least Preferred
Plastic Pollution in the Five Gyres

- **North Pacific Gyre**: Plastic pollution outweighs plankton six to one.
- **North Atlantic Gyre**: Heavier plastics, like polystyrene spherules, are more likely to be found near land as they do not float.
- **South Pacific Gyre**: Ocean currents carry plastic pollution into accumulation zones called gyres.
- **South Atlantic Gyre**: Plastic pollution is becoming apparent even in the most remote areas.
- **Indian Ocean Gyre**: Crabs and other biota are catching rides on floating plastic, posing a risk of spreading invasive species.

Map source: fine world maps.net
HAZARDOUS WASTES

- Driving force
  - Economic pressure
  - Lower environmental Standards
  - Less human health protection
ALANG, GUJARAT, INDIA

- The World’s Biggest Ship Breaking Yard

Toxic wastes cover the yards in Alang, Gujarat.
HAZARDOUS WASTES

- Artificial reefing
  - Major pollutants: PCBs, Asbestos, Mercury

<table>
<thead>
<tr>
<th>Option</th>
<th>Estimated Discounted* Cost of Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Worst Case</td>
</tr>
<tr>
<td>Long-Term storage</td>
<td>1,750</td>
</tr>
<tr>
<td>Domestic Recycling</td>
<td>2,590</td>
</tr>
<tr>
<td>Reefing</td>
<td>560</td>
</tr>
<tr>
<td>Overseas Recycling</td>
<td>140</td>
</tr>
</tbody>
</table>

* Figures are based on FY00 dollar values and a discount rate of 4.1 percent was used, per Office of Management and Budget, Circular A-94, at http://www.whitehouse.gov/OMB/circulars/a094/a094.html.

Source: http://ban.org/library/reports_Reefing_Madness_Final_May_06.pdf
How are these transboundary/global environmental issues directly or indirectly affecting human health?

- Ozone Depletion and Ultraviolet Radiation
- Climate Change and the Greenhouse Effect
- Deforestation and Desertification
- Biodiversity
- Acid Deposition
  - Ground-level ozone
- Waste Management
GLOBAL CHEMICAL CONTAMINATION

- CFCs
- POPs
  - DDT
  - PCBs
- Heavy metals
  - Mercury
  - Cadmium
POLLUTIONS TO THE ARCTIC

- CFCs - Ozone Depletion;
- POPs - Bio-accumulation and health effects; &
- ANY other chemicals carried in air and ocean currents
TABLE 1. Halving Times (in Years) of the Main Compounds and Compound Groups in the Three Different Phases and the Weighted Averages of These Times in All Phases Combined Together (The Latter Regressions Are Shown in Figure 1)

<table>
<thead>
<tr>
<th>compound</th>
<th>particle phase</th>
<th>vapor phase</th>
<th>precipitation</th>
<th>combined phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>total PCBs</td>
<td>--</td>
<td>14.9 $\pm$ 1.1</td>
<td>NS</td>
<td>17.0 $\pm$ 1.6</td>
</tr>
<tr>
<td>phenanthrene</td>
<td>8.3 $\pm$ 0.6</td>
<td>18.5 $\pm$ 2.2</td>
<td>11.1 $\pm$ 1.6</td>
<td>11.0 $\pm$ 0.6</td>
</tr>
<tr>
<td>chrysene</td>
<td>9.0 $\pm$ 0.8</td>
<td>9.7 $\pm$ 0.9</td>
<td>11.5 $\pm$ 1.9</td>
<td>9.67 $\pm$ 0.51</td>
</tr>
<tr>
<td>total endosulfans</td>
<td>11.1 $\pm$ 1.2</td>
<td>13.1 $\pm$ 1.9</td>
<td>14.5 $\pm$ 3.8</td>
<td>13.5 $\pm$ 1.3</td>
</tr>
<tr>
<td>total DDTs</td>
<td>5.8 $\pm$ 0.6</td>
<td>8.2 $\pm$ 0.4</td>
<td>14.9 $\pm$ 4.6</td>
<td>8.61 $\pm$ 0.44</td>
</tr>
<tr>
<td>total chlordanes</td>
<td>5.7 $\pm$ 0.4</td>
<td>11.2 $\pm$ 0.8</td>
<td>3.9 $\pm$ 0.3</td>
<td>6.39 $\pm$ 0.25</td>
</tr>
<tr>
<td>$\gamma$-HCH</td>
<td>5.1 $\pm$ 0.4</td>
<td>4.0 $\pm$ 0.1</td>
<td>2.7 $\pm$ 0.2</td>
<td>3.48 $\pm$ 0.07</td>
</tr>
<tr>
<td>$\alpha$-HCH</td>
<td>4.0 $\pm$ 0.7</td>
<td>3.4 $\pm$ 0.1</td>
<td>2.9 $\pm$ 0.1</td>
<td>3.26 $\pm$ 0.05</td>
</tr>
</tbody>
</table>

**EX. MERCURY**

**Global mercury cycling**

Mercury is released to the environment from natural sources and processes and as a result of human activities. Once it has entered the environment, mercury cycles between air, land, and water until it is eventually removed from the system through burial in deep ocean sediments or lake sediments and through entrapment in stable mineral compounds. Methylmercury, the most toxic and bioaccumulative form of mercury, which presents the greatest health risk to humans and wildlife, is mainly formed in aquatic environments through natural microbial processes.

Global mercury budgets, based on models, illustrate the main environmental compartments and pathways that are of importance in the global mercury cycle, and the ways in which natural and anthropogenic releases to air, land, and water move between these compartments. Emissions to air arise from natural sources and anthropogenic sources, as well as re-emissions of mercury previously deposited from air onto soils, surface waters, and vegetation.
Nonylphenol ethoxylates (NPEs)
- a group of chemicals used as surfactants, emulsifiers, dispersants and wetting agents
- residues of NPEs within the final product which are readily released when the items are washed as part of their normal use
- break down to form nonylphenol, a closely related group of persistent, bioaccumulative and toxic chemicals (OSPAR 2004, Jobling et al. 1996).

<table>
<thead>
<tr>
<th>Brand</th>
<th>Number of samples</th>
<th>Number tested positive</th>
<th>NPE concentration range, when detected (mg/kg)</th>
<th>Median of detected levels (mg/kg)</th>
<th>Median of all levels (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armani</td>
<td>9</td>
<td>5</td>
<td>1.2 – 43</td>
<td>8.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Benetton</td>
<td>9</td>
<td>3</td>
<td>6.3 – 95</td>
<td>11</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Blazek</td>
<td>4</td>
<td>2</td>
<td>47 – 330</td>
<td>190</td>
<td>24</td>
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<tr>
<td>C&amp;A</td>
<td>6</td>
<td>5</td>
<td>1.7 – 45 000</td>
<td>63</td>
<td>35</td>
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<tr>
<td>Calvin Klein</td>
<td>8</td>
<td>7</td>
<td>5.6 – 4 000</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Diesel</td>
<td>9</td>
<td>3</td>
<td>6.6 – 710</td>
<td>16</td>
<td>&lt;1</td>
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<td>Esprit</td>
<td>9</td>
<td>6</td>
<td>1.1 – 770</td>
<td>47</td>
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<td>Gap</td>
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<td>7</td>
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<td>8.6</td>
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<td>H&amp;M</td>
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<td>2</td>
<td>1.6 – 8.7</td>
<td>5.2</td>
<td>&lt;1</td>
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<td>Jack &amp; Jones</td>
<td>5</td>
<td>3</td>
<td>4.6 – 2 100</td>
<td>17</td>
<td>4.6</td>
</tr>
<tr>
<td>Levi’s</td>
<td>11</td>
<td>7</td>
<td>5.7 – 4 100</td>
<td>80</td>
<td>9.7</td>
</tr>
<tr>
<td>Mango</td>
<td>10</td>
<td>6</td>
<td>1.3 – 9 800</td>
<td>690</td>
<td>4.3</td>
</tr>
<tr>
<td>Marks &amp; Spencer</td>
<td>6</td>
<td>4</td>
<td>84 – 2 090</td>
<td>590</td>
<td>319</td>
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<tr>
<td>Metersbonwe</td>
<td>4</td>
<td>3</td>
<td>140 – 2 100</td>
<td>1 500</td>
<td>795</td>
</tr>
<tr>
<td>Only</td>
<td>4</td>
<td>4</td>
<td>5.5 – 730</td>
<td>35</td>
<td>35</td>
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<tr>
<td>Tommy Hilfiger</td>
<td>9</td>
<td>6</td>
<td>3.9 – 500</td>
<td>24</td>
<td>8.6</td>
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<tr>
<td>Vanci</td>
<td>4</td>
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<td>7.6 – 150</td>
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<td>5</td>
<td>4</td>
<td>6.3 – 130</td>
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<td>31</td>
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<td>Victoria’s Secret</td>
<td>4</td>
<td>2</td>
<td>7.0 – 10</td>
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<td>Zara</td>
<td>10</td>
<td>6</td>
<td>9.6 – 2 600</td>
<td>27</td>
<td>14</td>
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</table>

Source: Greenpeace
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES — GENERAL

- Aging Population
- Global Economy
- Public Health and Environmental Workforce
- Disparities
- Health Care Costs
Age and Gender Distribution of the U.S Population, 1999 and 2025
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES — GENERAL

- Aging Population
- Global Economy
- Public Health Workforce
- Disparities
- Health Care Costs
<table>
<thead>
<tr>
<th>Lehman Brothers</th>
<th>Bear Stearns</th>
<th>RBS</th>
</tr>
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<tbody>
<tr>
<td>Failed</td>
<td>Taken over</td>
<td>Bail out</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lloyds TSB</td>
<td>Citibank</td>
<td>Bail out</td>
</tr>
<tr>
<td>Bail out</td>
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<td></td>
<td></td>
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<tr>
<td>Freddie Mac</td>
<td>Bank of America</td>
<td>Bail out</td>
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<td>Bail out</td>
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<td></td>
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</tr>
<tr>
<td>Northern Rock</td>
<td>Bradford &amp; Bingley</td>
<td>Nationalised</td>
</tr>
<tr>
<td>Nationalised</td>
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<td></td>
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<td>Merrill Lynch</td>
<td>Alliance Leicester</td>
<td>Taken over</td>
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<td>Taken over</td>
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</table>
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES—GENERAL

- Aging Population
- Global Economy
- Public Health Workforce
- Disparities
- Health Care Costs
<table>
<thead>
<tr>
<th>Industry</th>
<th>May 1984</th>
<th>May 2005</th>
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<td>Agriculture, Forestry and Fishing</td>
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<td>Personal and Other Services</td>
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<td>All Industries</td>
<td>25.6</td>
<td>16.2</td>
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Sources: ABS, Wage and Salary Earners. Public Sector, Australia (Cat. No. 6248.0.55.001)

ABS, Labour Force, Australia. Detailed - Electronic Delivery (Cat. No. 6291.0.55.001)
Diminishing public health workforce

- 448,254 employed in 2000
- 50,000 fewer in 2000 than in 1980
- Retirement in 2009 expected to be as high as 45%
- 23% eligible to retire by 2012
Public Health Workforce

- Diminishing public health workforce
  - In 2007, ~42% of state epidemiology workforce lacked formal training
  - More than 50% of state lack qualified individuals willing to relocate to underserved areas
  - 738,771 estimated size of workforce needed in 2020, or 250,000 more workers
PUBLIC HEALTH AND ENVIRONMENTAL WORKFORCE

- Diminishing public health workforce
  - The public health workforce continues to decrease secondary to retirement and layoffs due to decreasing revenues from taxes, grants, and contracts
  - S1142 PH Workforce Development Act of 2009
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES—GENERAL

- Aging Population
- Global Economy
- Public Health Workforce
- Disparities
- Health Care Costs
Percentage of disability-adjusted life years (DALYs) attributed to 19 leading risk factors, by country income level, 2004

- Childhood underweight
- Unsafe sex
- Alcohol use
- Unsafe water, sanitation, hygiene
- High blood pressure
- Tobacco use
- Suboptimal breastfeeding
- High blood glucose
- Indoor smoke from solid fuels
- Overweight and obesity
- Physical inactivity
- High cholesterol
- Occupational risks
- Vitamin A deficiency
- Iron deficiency
- Low fruit and vegetable intake
- Zinc deficiency
- Illicit drugs
- Unmet contraceptive need

Per cent of global DALYs (total: 1.53 billion)

Health Statistics and Informatics
World Health Organization
Deaths attributed to 19 leading factors, by country income level, 2004

- High blood pressure
- Tobacco use
- High blood glucose
- Physical inactivity
- Overweight and obesity
- High cholesterol
- Unsafe sex
- Alcohol use
- Childhood underweight
- Indoor smoke from solid fuels
- Unsafe water, sanitation, hygiene
- Low fruit and vegetable intake
- Suboptimal breastfeeding
- Urban outdoor air pollution
- Occupational risks
- Vitamin A deficiency
- Zinc deficiency
- Unsafe health-care injections
- Iron deficiency

Mortality in thousands (total: 58.8 million)

High Income
Middle income
Low Income
DISPARITIES

- Health Disparities may come from:
  - Lacking access to essential resources
  - Environmental, Social, and Economic In-justice
- In poor populations
  - Maternal and infant mortality is unnecessarily high
  - Suicide increases with unemployment
  - Lower life expectancies
MATERNAL MORTALITY IS HIGH IN POOR COUNTRIES

Causes of maternal death
- Severe bleeding (haemorrhage) 25%
- Infections 15%
- Eclampsia 12%
- Obstructed labour 8%
- Unsafe abortion 13%
- Other direct causes 8%
- Indirect causes 20%

Comparison of International Infant Mortality Rates: 2000

Source (II.2): Centers for Disease Control and Prevention, National Center for Health Statistics

Deaths per 1,000 Live Births

* Includes data for East Jerusalem and Israeli residents in certain other territories under occupation by Israel military forces since June 1967.
Similarly infant mortality is also high
Premature mortality rates for populations of color (solid lines) undergo a steep decline, beginning around 1966, and a leveling off, beginning around 1980.

White populations (dashed lines) exhibit a general decline in mortality, though the rate after 1980 is variable. The poorest white quintiles exhibit a leveling off while mortality rates continue to drop in the most affluent white quintiles. Interestingly, mortality also continues to decline in the most affluent minority quintile.

Source: http://archives.focus.hms.harvard.edu/2008/040408/health_policy.shtml
The average life expectancy is 30 years less in Africa than in the Americas or Europe.

A child born in Zimbabwe or Swaziland has a life expectancy less than half as long as one born in Japan.

A child born in Angola is 73 times more likely to die than one born in Norway.

Suicide and violence increase with increasing unemployment

**Figure 4: Gini Index for Homicide Based on Florida ZIP Codes**
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES—GENERAL

- Aging Population
- Global Economy
- Public Health and Environmental Workforce
- Disparities
- Health Care Costs
Rising health care costs hitting the pocketbook

National spending for out-of-pocket health care costs is projected to steadily increase over the next decade

Source: National Health Expenditures, January 2007, Centers for Medicare & Medicaid Services, Office of the Actuary
Chemical contamination of food

- Melamine
  - Pet food
  - Human food
- Heavy metals
- Pesticides
- Antibiotics
Melamine in Pet Food

- **Cat Foods**—68 Brands, multiple products
  - Iams
  - Nutro
  - Science Diet

- **Dog Foods**—81 Brands, multiple products
  - Alpo
  - Iams
  - Mighty Dog
**Figure 4.** Partial chain of production and distribution of melamine in wheat flour sold as rice protein concentrate. Dates in italics indicate dates of recall notices. Companies are located in the United States unless otherwise indicated.
Melamine in Milk

- 300,000 Chinese infants ill
- 6,244 infants hospitalized
- 6 deaths
- 900 tons of milk contaminated with melamine
- Infants developed kidney stones and other renal complications from crystal depositing in glomeruli
Chemical contamination of food
- Melamine
- Heavy metals
  - Arsenic
  - Cadmium
  - Lead
  - Mercury
- Pesticides
Pollution builds up over a lifetime:

Body burden levels in mothers are higher than in daughters.

Lead
PBDEs (Brominated flame retardants)
PFCs (Teflon & Scotchgard chemicals)
Methyl-mercury
Chemical contamination of food
- Melamine
  - Pet food
  - Human food
- Heavy metals
- Pesticides
<table>
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<tr>
<th>Pesticide</th>
<th>NOAEL (mg/kg bw/day)</th>
<th>UF</th>
<th>TDI (%)</th>
<th>GV (µg/liter)</th>
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<tr>
<td>Atrazine</td>
<td>0.5</td>
<td>1000</td>
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<td>Bentazone</td>
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<td>100</td>
<td>10</td>
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<td>100</td>
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<td>7</td>
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<td>2,4-D</td>
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<td>10</td>
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<td>Glyphosate</td>
<td>175</td>
<td>100</td>
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<td>Metolachlor</td>
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<td>10</td>
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<td>Molinate</td>
<td>0.2</td>
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<td>Pendimethalin</td>
<td>5</td>
<td>1000</td>
<td>10</td>
<td>20</td>
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<td>Propanil</td>
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<td>1000</td>
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<td>20</td>
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<tr>
<td>Pyridate</td>
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<td>Simazine</td>
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<td>0.75</td>
<td>100</td>
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*U = Unnecessary to recommend a health-based GV since the calculated value (5 mg/liter) is orders of magnitude higher than glyphosate concentrations normally found in drinking water.
NOAEL: No-observed-adverse-effect level
UF: Uncertainty factor
TDI: Tolerable daily intake
GV: Guideline value
EMERGING, RE-EMERGING, OR PERSISTING ENVIRONMENTAL HEALTH ISSUES

FOOD SAFETY

- **Problems**
  - Food industry self-regulation inadequate
  - Safety inspections divided among state and federal agencies
  - FDA and USDA inadequately staffed
  - Politics
- **Solution**
  - Fix the problems
  - Public knowledge
  - Purchasing power
Emerging or Re-Emerging Public Health Issues

Infectious Disease

- Tuberculosis (MDR and XDR)
- Dengue
- Influenza
- Salmonellosis
- MRSA
- Bat White-Nose Syndrome
FIGURE 1. Rate* of tuberculosis (TB) cases, by state/area — United States, 2008†

* Per 100,000 population.
† Data updated as of February 18, 2009. Data for 2008 are provisional.
§ TB rate cutoff points were based on tertiles: 18 states had TB case rates of <2.0 (range: 0.46–1.99) per 100,000, 17 states had TB case rates of 2.0–4.0 (range: 2.03–3.92) per 100,000, and 15 states and the District of Columbia had TB case rates of >4.0 (range: 4.02–9.63) per 100,000.
FIGURE. Number of confirmed and suspected multidrug-resistant tuberculosis cases (N = 21) in two outbreaks, * by initial sputum collection date — Chuuk State, Federated States of Micronesia, 2007–2009†

* Based on geographic location, genotypes, and drug-resistance patterns.
† As of March 13, 2009.
§ Resistance to isoniazid, rifampin, ethambutol, pyrazinamide, and streptomycin.
¶ Resistance to isoniazid, rifampin, and ethionamide.
** Investigation by CDC and World Health Organization began in July 2008.
EXTENSIVELY DRUG RESISTANT TUBERCULOSIS (XDR-TB)

- The term first used in March, 2006 by CDC and WHO
- XDR-TB is disease caused by strains of *M. tuberculosis* resistant not only to INH and rifampicin (MDR-TB), but at least 3 of the 6 classes of 2nd line anti-TB drugs
Total MDR= 3520, XDR= 347 (~10% of MDR)

Industrialized Nations
- XDR 53 (6%)

E. Europe
- XDR 55 (14%)

Latin America
- XDR 32 (6%)

Asia
- XDR 204 (12%)

Africa, Middle East
- XDR 1 (1%)
EMERGING OR RE-EMERGING PUBLIC HEALTH ISSUES— INFECTIOUS DISEASE

- Tuberculosis (MDR and XDR)
- Dengue
- Influenza
- Salmonellosis
- MRSA
- Bat White-Nose Syndrome
Dengue

- No cases since 1945
- Increasing frequency of transmission in the United States beginning in 1980s
- 122 case outbreak in Hawaii, 2001-2
- 24 locally acquired cases in Texas, 2005
- First indigenous transmission in U.S.
- *Aedes albopictus* increasing range
- Probably a function of global warming
American Countries with laboratory confirmed dengue hemorrhagic fever, prior to 1981 and from 1981 to 2003

Prior to 1981

1981 - 2003

Source: WHO/PAHO/CDC, Aug. 2004
Emerging or Re-emerging Public Health Issues—Infectious Disease

- Tuberculosis (MDR and XDR)
- Dengue
- Influenza (H5N1, H1N1)
- Salmonellosis
- MRSA
- Bat White-Nose Syndrome
THE EPIDEMICS

- *Salmonella typhimurium*, 2008-2009
  - Peanut butter, peanut paste, roasted peanuts(?)
- *Salmonella Saintpaul*, 2008
  - Tomatoes, Serrano and Jalapeño peppers
- *Salmonella enterica*-Schwarzengrund, 2008
  - Dog and cat food
THE EPIDEMICS

  - Peanut butter
- *Salmonella* serotype I 4,5,12:i, 2007
  - Frozen pot pies
- *Salmonella* multiple serotypes, 2004
  - Roma tomatoes
- *Salmonella* in pistachios, 2009
EMERGING OR RE-EMERGING PUBLIC HEALTH ISSUES—INFECTIOUS DISEASE

- Tuberculosis (MDR and XDR)
- Dengue
- Influenza
- Salmonellosis
- MRSA
- Bat White-Nose Syndrome
Antibiotic resistance is an increasing concern worldwide.  
- *S. aureus* has become resistant to penicillin and all related antibiotics.  
- MRSA has been mainly a problem in hospitals and nursing homes.  
- Only recently becoming community acquired.
MRSA

- Increasing frequency in the United States
- Increasing number of cases in Kentucky
- Three recent cases in high school students in 2009
- One death secondary to influenza
MRSA

Infection acquired by:
- Sharing contaminated sports equipment, towels, other personal items
- Skin-to-skin contact
- Infection via an open wound
- Hands
Causes:
- Folliculitis
- Boils
- Carbuncles
- Impetigo
- Other skin conditions
- Systemic disease
- Pneumonia
The problem is here, now!
- In hospitals
- In nursing homes
- In the community
- In schools

It will be around for a long, long time
Emerging or re-emerging public health issues—Infectious Disease

- Tuberculosis (MDR and XDR)
- Dengue
- Influenza
- Salmonellosis
- MRSA
- Bat White-Nose Syndrome
Bats in danger

White-nose syndrome is killing thousands of hibernating bats.

- White fungus
  Found on nose, wings, ears, tail

Important creatures
- One bat eats more than 3,000 insects in one night
- Pollinate about 600 to 1,000 plant species

Early risers
- Fungus wakes bats up from winter hibernation before there are enough insects to keep them from starving

Counties reporting WNS cases

First detected Feb. 2006
- Estimated 500,000 Northeastern bats have died since 2006

Source: New York Department of Environmental Conservation, Bat Conservation International

Graphic: Melina Yingling
Human Spread of White-Nose Syndrome: Why Decontamination is Important

Bat-to-bat transmission is believed to be the primary vector for the spread of the fungus Geomyces destructans, the likely cause of white-nose syndrome (WNS). WNS is a disease that is killing significant numbers of hibernating bats in eastern North America.

Research is underway to improve our understanding of WNS transmission, including the human element, and results of pilot studies are becoming available.

The U.S. Geological Survey, National Wildlife Health Center has detected fungal spores in cave sediment demonstrating persistence of fungus in the absence of bats (1).

Evidence suggests that WNS may be caused by an invasive fungus, probably from Europe.

Human-assisted transmission of WNS does not appear to be a frequent event. There have been suspicious jumps, however, of longer distances than the bats are likely to transmit the disease themselves. Jump sites have also been frequently visited locations, often with small bat populations relative to others in the area.

The New York State Department of Environmental Conservation, (NYSDEC) Wildlife Pathology Unit has isolated fungal spores on equipment and clothing after exiting a cave (2).

What can you do to help prevent the spread of WNS?
- Treat WNS as you would an invasive species
- Avoid any contact with potentially affected sites, equipment, or bats themselves
- Employ good stewardship practices such as cleaning and disinfecting your gear

Why is decontamination important?
- Reduces the potential for big jumps across the continent
- Slows the spread of disease
- Prevents the arrival/spread of other potential exotic invaders in the future

Citations:

A joint-agency project has also demonstrated that bats can develop WNS through infection directly from an affected cave environment, and in the absence of infected bats (3).