

Natural Disasters

Lecture 2

Ch 1 – Natural Disasters and the Human Population

Text Source Today:

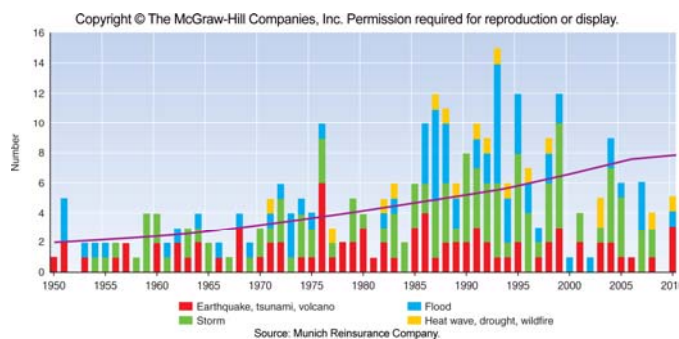
Chapter 1

1.2: Ch. 1 – Natural Disasters and the Human Population

♦ **Great Natural Disasters** are **natural events** that so overwhelm regions such that **international assistance** is needed to rescue and care for people, clean up the destruction, and begin the process of reconstruction.

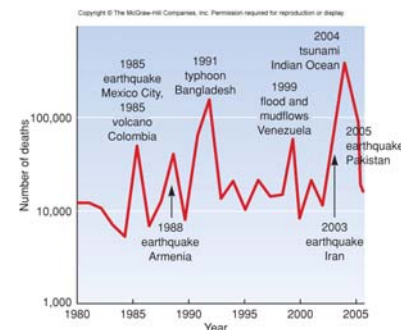
- ***Natural hazards are inevitable, but natural disasters are not.***

After a great natural disaster, people tend to use the same “bricks and stones” to rebuild their cities **on the same site**.



- ♦ From 1950 to present day, there has been a general **increase in great natural disasters** (Fig 1.3).

- **Fatalities vary greatly** from year to year.



- ♦ **Hurricanes and earthquakes** are the leading mega-killers, with the hardest hit area from **China and Bangladesh, through India to Iran and Turkey**.

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TABLE 1.2
Fatalities from Natural Disasters, 1947–1980

	Earthquake	Tsunami	Volcanic Eruption	Flood	Hurricane	Tornado	Other Severe Weather	Landslide/Avalanche	Life Loss Totals by Geographic Area
Number of Killing Events	180	7	18	333	210	119	147	45	
North America	77	60	96	1,633	1,997	4,568	5,003	323	13,757
Caribbean and Central America	30,613	—	151	2,575	16,541	26	510	260	50,676
South America	38,837	—	440	4,396	—	—	340	5,262	49,275
Europe	7,750	—	2,000	11,199	250	39	6,816	640	28,694
Asia	354,521	4,459	2,805	170,664	478,574	4,308	34,403	4,356	1,054,090
Africa	18,232	—	—	3,891	864	548	5	—	23,540
Oceania	18	—	4,000	77	290	—	117	—	4,502
Life loss totals by Earth process	450,048	4,519	9,492	194,435	498,516	9,489	47,194	10,841	Life loss total = 1,224,534

Source: Data from Shah (1983).

● **Human responses to a disaster:** after **initial shock and disbelief**, emotions of **sympathy and empathy** take over. People tend to change from **inward**-directed concerns (personal priorities) to **outward**-directed concerns (humanitarian and community-oriented actions). People become **better connected and cohesive, with a desire to “add to the common good.”**

● **Economic losses from natural disasters:** most insured losses are due to **weather (earthquakes a distant second)** and are concentrated in **wealthy countries (USA, Europe, Japan)**, which are **better insured** and their people live in safer buildings

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TABLE 1.4 Dollar Losses from Great Natural Disasters 1950–2005 (Billions of 2005 US\$)							
Years	1950–59	1960–69	1970–79	1980–89	1990–99	Last 10 Years	Increase in Last 10 Years Compared to 1960–69
Number great events	21	27	47	63	91	57	2.1 times
Economic losses	48.1	87.5	151.7	247.0	728.8	575.2	6.6 times
Insured losses	1.6	7.1	14.6	29.9	137.7	176.0	24.8 times

Source: Data from Munich Reinsurance Company (2006).

◆ As the **magnitude** of an event **increases**, its **frequency** of occurrence **decreases**.

◆ **Return period** is the number of years between same-sized events, also known as **recurrence interval**.

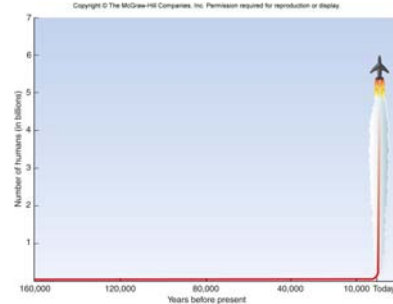
◆ Using **magnitude, frequency and return period** for a given event allows for **cost-benefit decision making**.

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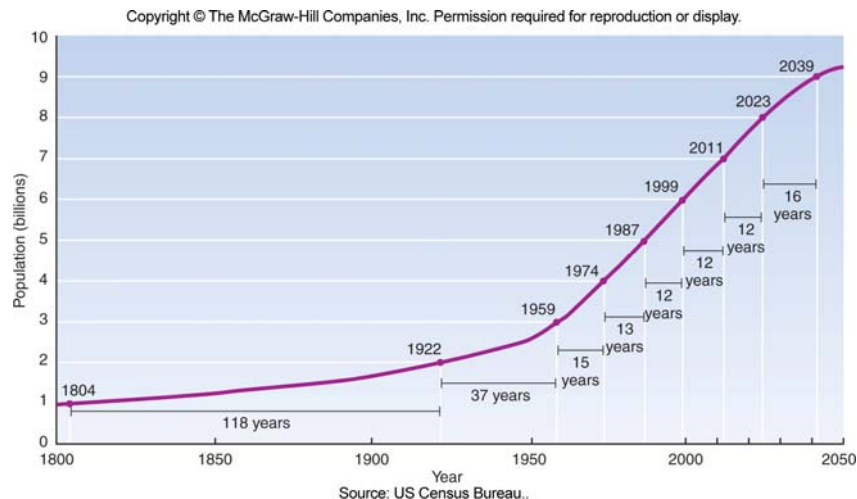
TABLE 1.6 Probability Estimates for 10- and 1,000-Death Natural Disasters in the United States				
Likelihood of a 10-Fatality Event				
	During 1 Year	During 10 Years	During 20 Years	Return Time (in Years)
Earthquakes	11%	67%	89%	9
Hurricanes	39	99	>99	2
Floods	86	>99	>99	0.5
Tornadoes	96	>99	>99	0.3
Likelihood of a 1,000-Fatality Event				
	During 1 Year	During 10 Years	During 20 Years	Return Time (in Years)
Earthquakes	1%	14%	26%	67
Hurricanes	6	46	71	16
Floods	0.4	4	8	250
Tornadoes	0.6	6	11	167

Source: US Geological Survey Fact Sheet (unnumbered).

- **Population growth** is an example of **exponential growth** and displays the so-called **“hockey stick” pattern** (Fig 1.6).



- ◆ Dating back **160,000 years**, there was not much growth in population, but **after 1800 CE**, the human population began to soar, as people lived longer (due to **advances in medical and living conditions**) while the numbers of deaths during **childbirth and infancy** were greatly reduced. The global population **doubled twice** during the 20th century! (Fig 1.9)

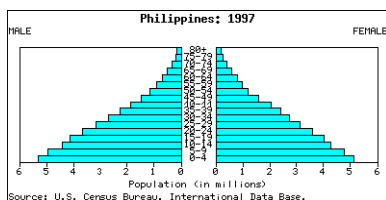


- ◆ The **“Rule of 70”** allows approximation of doubling times:

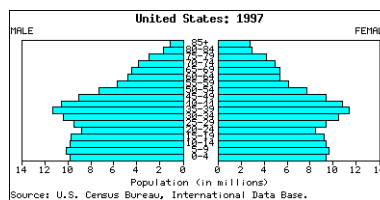
$$\text{Doubling time (in years)} = \frac{70}{\% \text{ growth rate/year}}$$

- Current world population growth is about **1.2%**, obtained by measuring the **birth (fertility) rate** and subtracting the **death (mortality) rate**. This gives a doubling time of **58 years**.

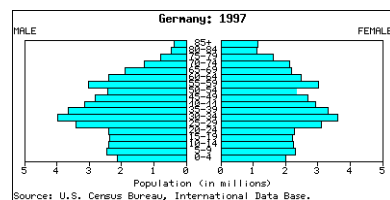
- The current **1.2%** rate produces a net increase of **2.5 people per second**, or **8250** people during our 55 minute class!
 - More-developed countries have gone through a **demographic transition**, where they have **low** death rates and **low** birth rates.
 - World population growth has been **decreasing**, likely due to **urbanization** and increased opportunities for **women**.
 - **Urban families** have greater access to education, health care, higher incomes and family-planning materials. Many **urban women** choose to have fewer children and bear them later.
 - There is a **demographic divide** that separates **wealthy** countries (**low** birth rates and **long** life expectancies) from some **poor** countries (**high** birth rates and **short** life expectancies).
- ♦ **Population pyramids** display the **demographic** characteristic of a population in its **age-sex structure**:



Rapid Growth
(~2.1%)



Slow Growth
(~1.7%)



Negative Growth
(-0.1%)

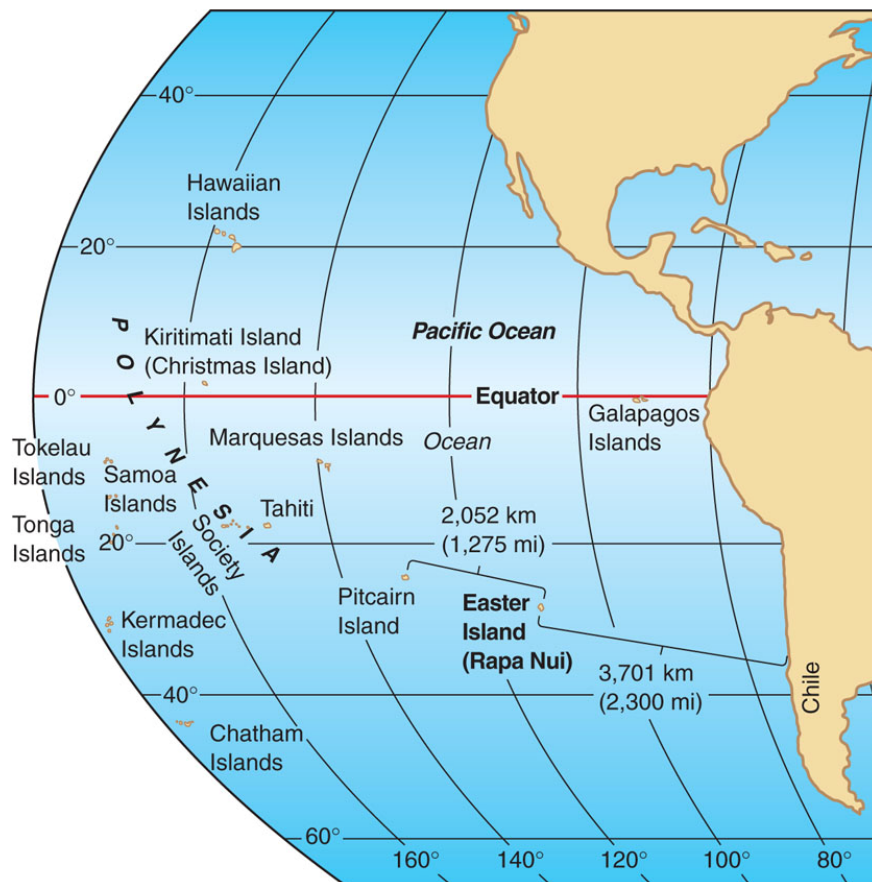
<http://www.worldlifeexpectancy.com/world-population-pyramid>

Easter Island (Rapa Nui)

- **isolated**, volcanic island in the South Pacific
 - high temperatures and humidity
 - poorly drained and marginal soils
 - no permanent streams
 - no terrestrial mammals
 - few varieties of fish in the surrounding sea
 - year-round water only in little lakes in the volcano caldera
 - 30 native plant species and trees (in locally dense growths)
- 
- ~1000 years ago, 25-50 Polynesian settlers arrived
 - they brought chickens and several food plants, but the only food plant that survived the harsh climate was the yam
 - they chopped down trees to build houses and canoes
 - a mammoth stone statue building contest began between clans
 - they chopped down more trees to transport (roll) the statues
 - they destroyed the forests in the fierce statue competition
- about 1550 CE, their population peaked at ~7000 people
 - from there, their population declined rapidly and savagely
 - the lack of trees meant no houses could be built or repaired
 - there was little fuel for cooking (or heat in cooler weather)
 - soil erosion reduced agricultural production
 - the lack of trees meant no more canoes or repaired older ones
 - the lack of canoes meant they could not catch enough fish
- about 1722 CE, a Dutch ship found the surviving ~2000 living in caves in a primitive society of nearly constant warfare and cannibalism!
 - they did not consider the health of the environment

- **Easter Island (Rapa Nui)**

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Some important questions:

♦ What is the **carrying capacity** for humans on Earth? In other words, what is the **largest population** that can subsist on available resources?

What if **sudden climate change** decreased **global food production and/or available drinking water**, and caused the human population to exceed Earth's carrying capacity?

Could human value systems change fast enough to solve the problem?

How would the entire planet react to an “Easter Island” scenario???

Earth is but a tiny “island” in the vast “ocean” of the universe.

There is nowhere else for us to go, and no one will be there to rescue us!

♦♦ Population scenarios for the year **2150**, if each woman averages:

- 1) **1.6** children, world population drops to **3.6** billion
- 2) **2.0** children, world population grows to **10.8** billion
- 3) **2.6** children (which is the present average), world population soars to **27** billion!

♦ **The difference between world population in 2150 of 3.6 billion and 27 billion is only 1 child per woman!**