10/1 Population Characteristics CH 6

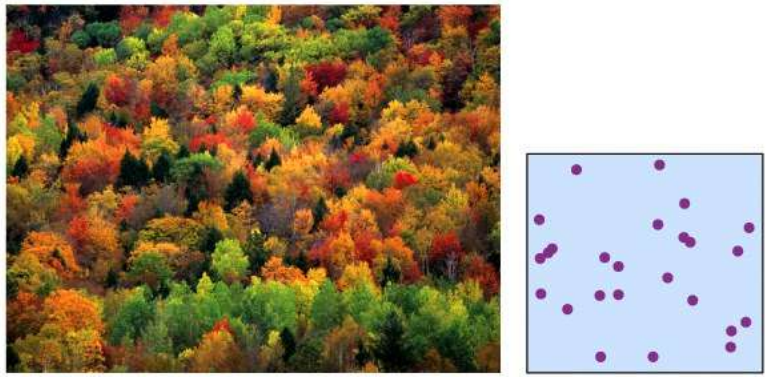
Obj., TSW identify population characteristics, other factors that influence them, and identify factors that affect wetland diversity, pg. 64

- 1. Explain metapopulations
- 2. What are some population characteristics?
- 3. What are some factors that affect wildlife diversity in wetlands? (answer later!)

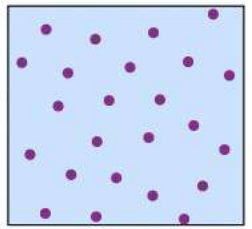
Factors that Regulate Population Abundance and Distribution

- **Population size-** the total number of individuals within a defined area at a given time.
- **Population density-** the number of individuals per unit area at a given time.
- **Population sex ratio-** the ratio of males to females
- **Population age structure-** how many individuals fit into particular age categories.
- **Population distribution-** how individuals are distributed with respect to one another.

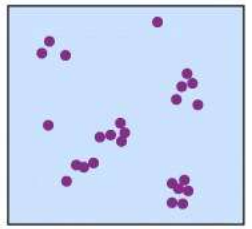
How Populations are distributed.



(a) Random distribution



(b) Uniform distribution



(c) Clumped distribution

Figure 6.3
Environmental Science

Metapopulations

- Metapopulations- a group of spatially distinct populations that are connected by occasional movements of individuals between them.

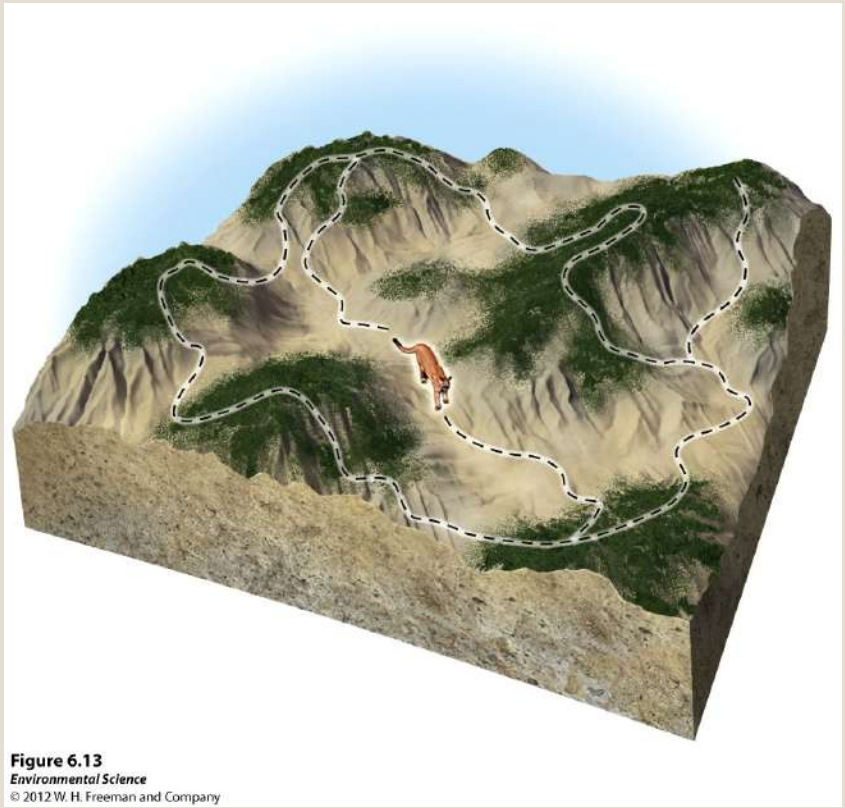


Figure 6.13
Environmental Science

Wetland Presentation pg. 63

- Groups of 3 or 4
- (1) Intro, Wetland Formation, California's Wetlands
- (2) The Salt Marsh, Adaptations, Why they Matter?
- (3) Great Basin
- (4) Mojave Desert
- (5) Sonoran

Include:

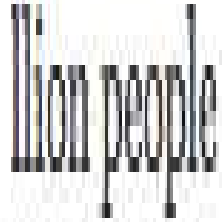
1. What are some factors that affect wildlife diversity in wetlands or your specific wetland?
2. Why is California considered a biodiversity hotspot?
3. Important information in your section, you are the expert!

In the News…

UN Data on Population Growth is Bad News for Climate

Published: *September 21st, 2014*

LONDON– The demographers may have got it wrong. New projections say the population of the planet will not stabilize at 9 billion sometime this century. In fact, there is an 80 percent likelihood that, by 2100, it will reach at least 9.6 billion – and maybe rise as high as 12.3 billion.



They add, grimly, that things could also get worse: "It should also be noted that the projections do not take into account potential negative feedback from the environmental consequences of rapid population growth.

"The addition of several billion people in Africa could lead to severe resource shortages, which in turn could affect population size through unexpected mortality, migration, or fertility effects."

10/2 Human Population CH 7

Obj. TSW learn about age structure graphs, demographic transition & practice population questions. P. 66 NB

AGE STRUCTURE GRAPHS

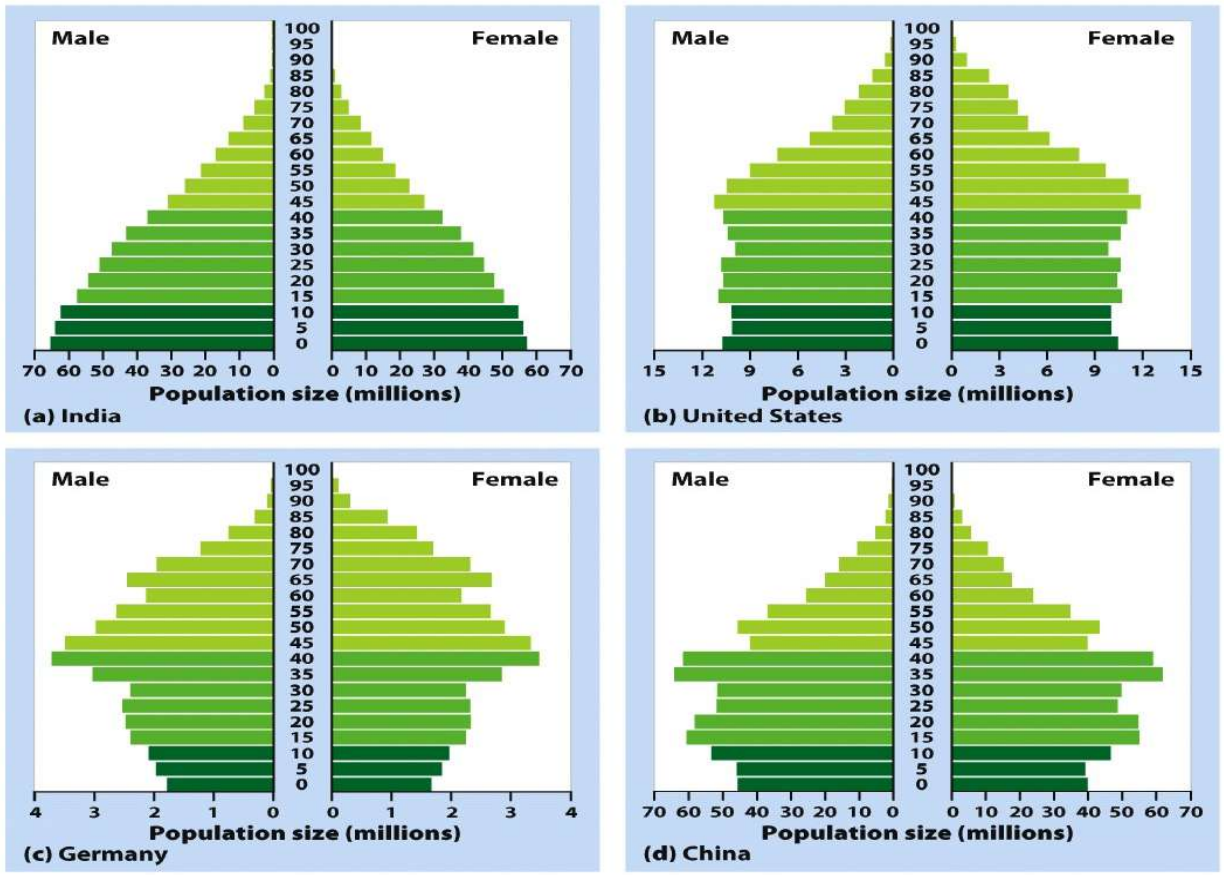


Figure 7.8
Environmental Science

1. Draw an Age Structure graph of a growing population.
2. RCHS population is 1976 students, 27 transfer in, 5 get expelled. What is the population growth of the high school?
3. Ecosystem question from yesterday!

Age Structure

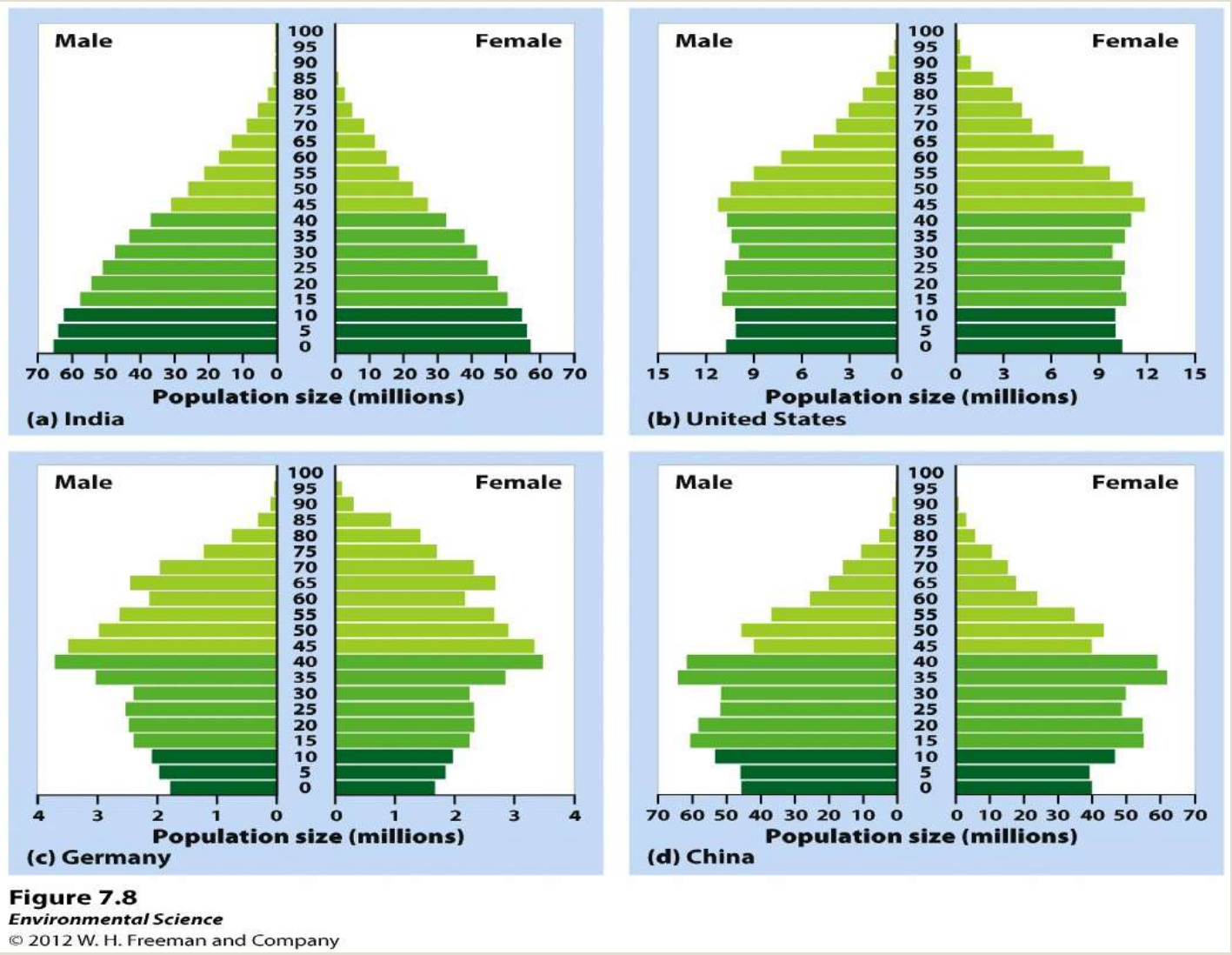


Figure 7.8
Environmental Science

Age structure diagrams (population pyramids)- visual representations of age structure within a country for males and females.

Changes in Population Size

- **Immigration**- the movement of people into a country
- **Emigration**- the movement of people out of a country.
- **Net migration rate-** the difference between immigration and emigration in a give year per 1,000 people in the country.

Figure 7.3
Environmental Science

Growth Rate

- Growth Rate = Births – Deaths
  - Movement of individuals =
    - Immigration
    - Emigration
  - (births + immigration) – (deaths + emigration) = population change

#2.

- Population Growth, NOT Growth rate
- (B + I) – (D + E) = 27 – 5 =
- The population of RCHS has increased by 22 people.

10/3 Human Population CH 7

Obj. TSW identify demography/factors that drive human population, identify the stages of demographic transition, and identify why scientists disagree about reaching the human carrying capacity, pg. 68

- 1. Explain demography and name the factors that drive human population growth
- 2. What are the four stages (Names) of demographic transition?
- 3. Explain the differing views scientist hold on if humans will reach a carrying capacity or not.

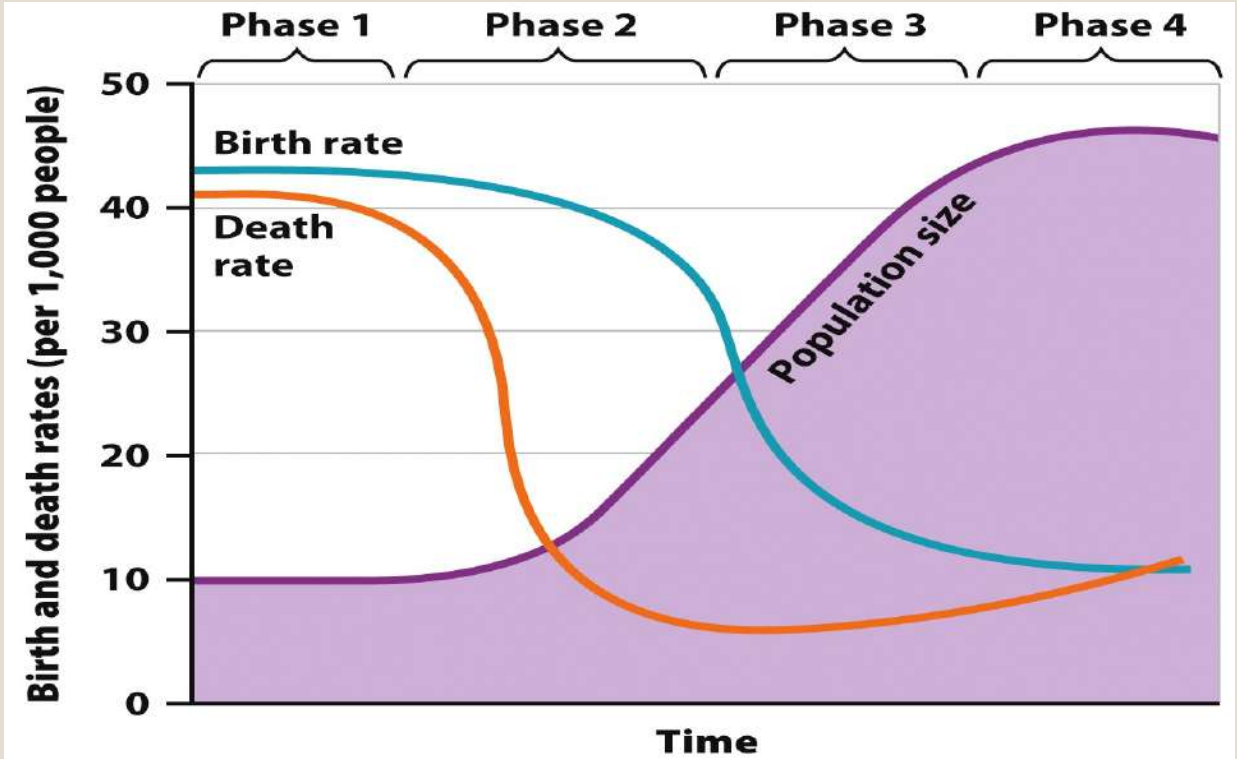


Figure 7.9
Environmental Science

Factors that Drive Human Population Growth

- **Demography**- the study of human populations and population trends.
  - Changes in Population Size
  - Fertility
  - Life Expectancy
  - Age Structure
  - Migration

The Demographic Transition

- The theory of the demographic transition is the theory that as a country moves from a subsistence economy to industrialization and increased affluence, it undergoes a predictable shift in population growth.

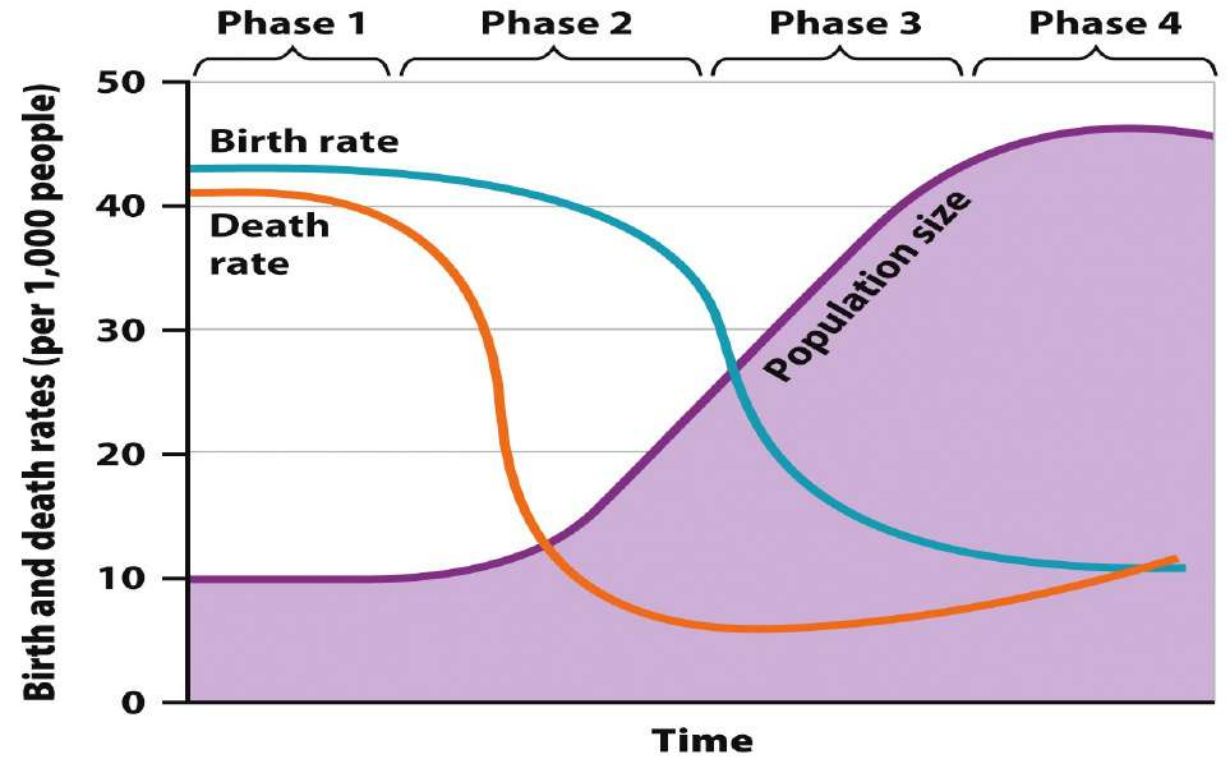


Figure 7.9
Environmental Science

The Stages of the Demographic Transition

- **Phase 1:** Slow population growth because there are high birth rates and high death rates which offset each other.
- **Phase 2:** Rapid population growth because birth rates remain high but death rates decline due to better sanitation, clean drinking water, increased access to food and goods, and access to health care.
- **Phase 3:** Stable population growth as the economy and educational system improves and people have fewer children.
- **Phase 4:** Declining population growth because the relatively high level of affluence and economic develop encourage women to delay having children.

Theory of Demographic Transition

- **Phase1** – Pre-Industrial – Before the industrial Revolution
- **Phase 2** – Transitional - India
- **Phase 3** – Industrial – US & Canada
- **Phase 4** – Post Industrial – UK, Germany, Russia, Italy, Japan

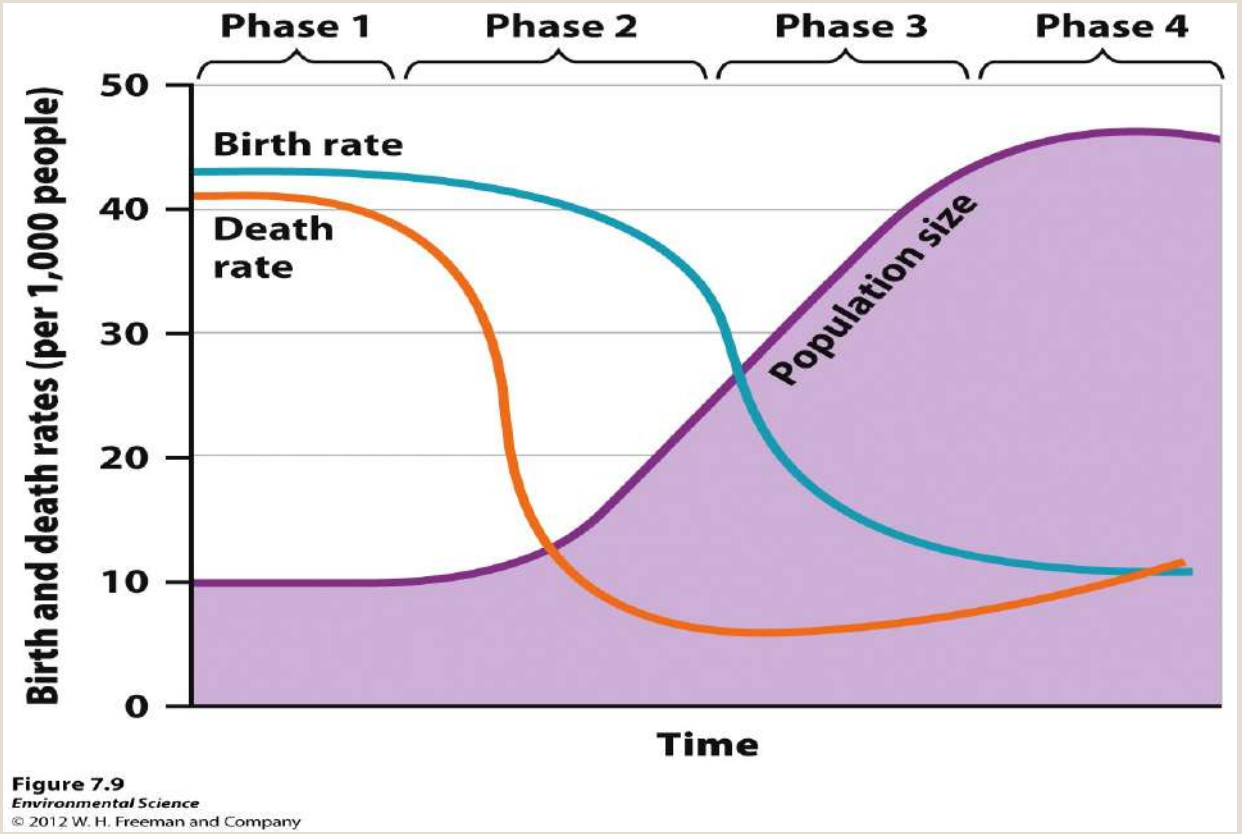


Figure 7.9
Environmental Science

Scientists Disagree on Earth's Carrying Capacity

- The following graphs show theoretical models of food supply and population size.

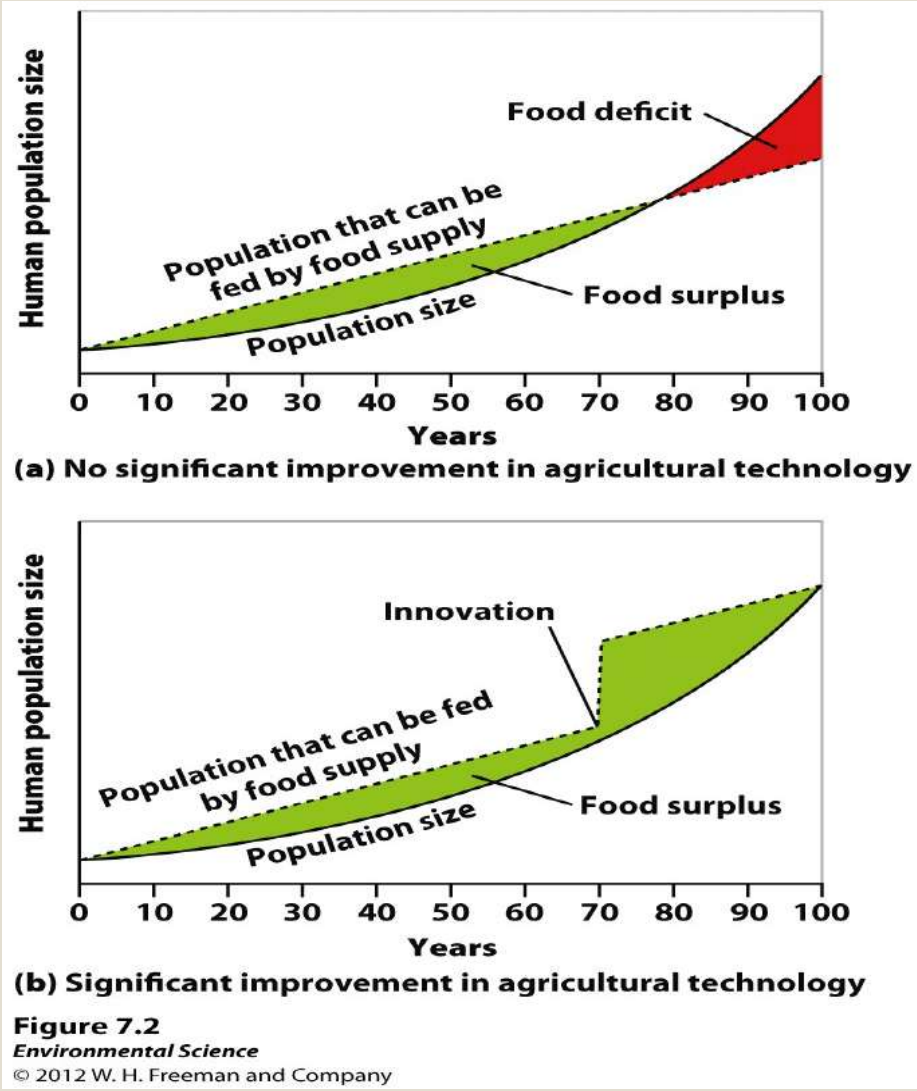


Figure 7.2
Environmental Science

Why Scientists Disagree about the Carrying Capacity?

- Believe outgrown OR will eventually outgrow available supply of resources such as food, water, timber, fuel, etc.
- Malthus= Human population growing exponentially but food supply growing linearly
  - Environmental Scientists still believe that we will reach our carrying capacity= human population growth will decline
- Do not believe there is a carrying capacity for humans
- Growing population provides an increasing supply of intellect that leads to increasing amounts of innovation
- Inventions/technological advances increase carrying capacity over time
  - Ex: Development of arrow made hunting more efficient

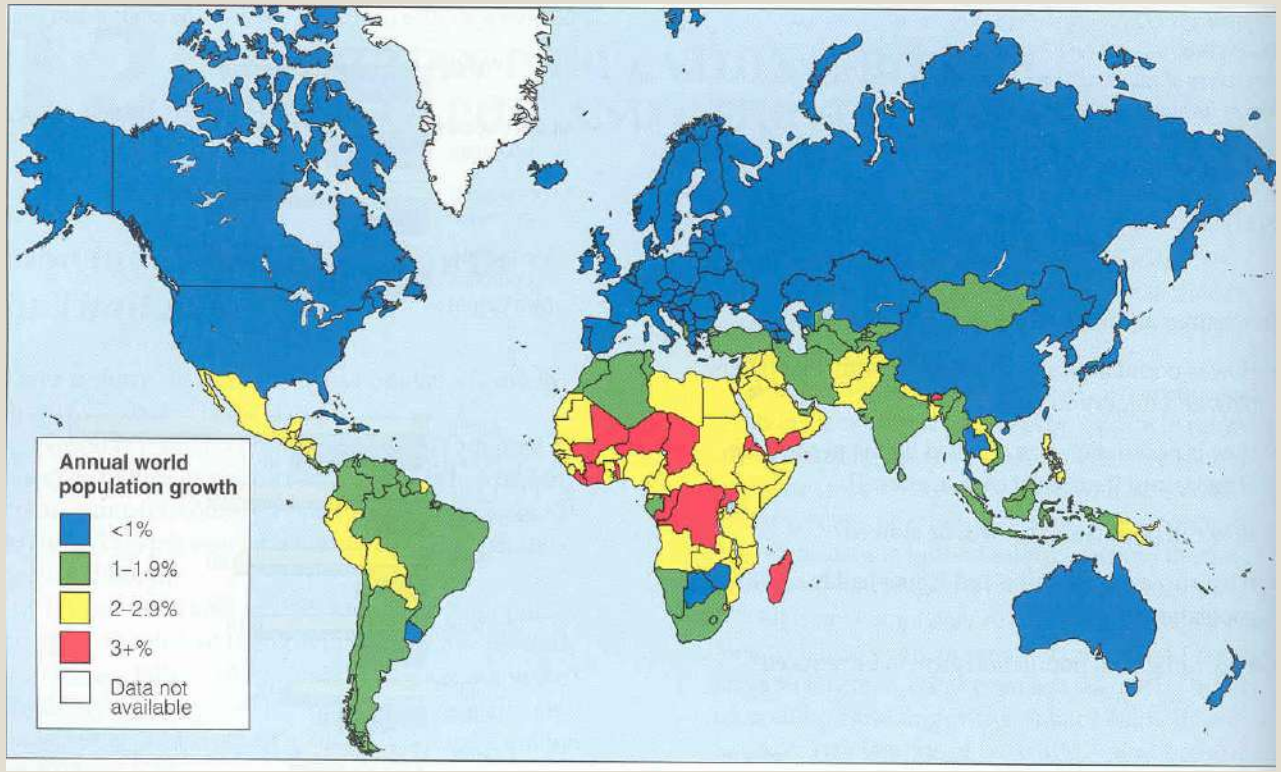
Chapter 7 Opener
Environmental Science

Chapter 7 The Human Population

10/6 Human Population CH 7

Obj. TSW be able to explain the relationship between economic development and affluence, the crude birth and death rate at the national and global level, and perform a practice problem, pg. 70

- 1. Explain both the crude birth and death rates, include the Equation at both the global and national level.
- 2. In 2050 there are 40 births and 18 deaths per 1,000 people. By what percentage did the global population increase? At that percentage about how many years will it take for the population to double?



Changes in Population Size

- Special measurement to determine yearly birth and death rates
- **Crude Birth Rate (CBR)=** # of births per 1000 individuals per year
- **Crude Death Rate (CDR)=** # of deaths per 1000 individuals per year
- "Crude"= Does not take age or sex differences among the population
- Divide by 10 to represent value as a %

Changes in Population Size

Global population growth rate =
(CBR- CDR)/ 10

National population growth rate =
(CBR+ immigration) – (CDR + emigration)/ 10

If we know growth rate of pop.= can calculate the # of years it takes for a population to double

Doubling time (in years)= 70/ growth rate

#3

- Global Population Growth Rate=

$$\frac{[\text{CBR} - \text{CDR}]}{10} = \frac{[40 - 18]}{10} = 2.2 \text{ percent}$$

Doubling Time (in years)=

$$\frac{70}{2.2} = \text{About 32 years}$$

10/7 Human Population CH 7

Obj. TSW identify how fertility, family planning, and life expectancy all affect population size and growth,

- 1. Explain how total fertility rate (TFR) is measured and what is used to gauge changes in population size?
- 2. Explain what "life expectancy" means and what it is a good predictor of?
- 3. Why do people produce fewer children as their income increases?

Total Fertility Rate

- Estimate of the average number of children that each woman in a population will bear throughout her childbearing years
- Measure of births per woman
  - EX) US is just over 2 children
- Replacement-Level Fertility
- The

Life Expectancy

Family Planning

Fertility

- TFR= Estimate of the average number of children that each woman in a population will bear

10/8 Human Population CH 7

Obj. TSW identify how ecological footprints are measured and the parts of the IPAT equation, pg. 72

- 1. Explain per capita ecological footprint. How do China's, the US's, & Haiti ecological footprint compare?
- 2. What is the IPAT equation?

Ecological Footprints

- **Affluence** - having a lot of wealth such as money, goods, or property.

- Provides a way to measure the effect of affluence on the planet

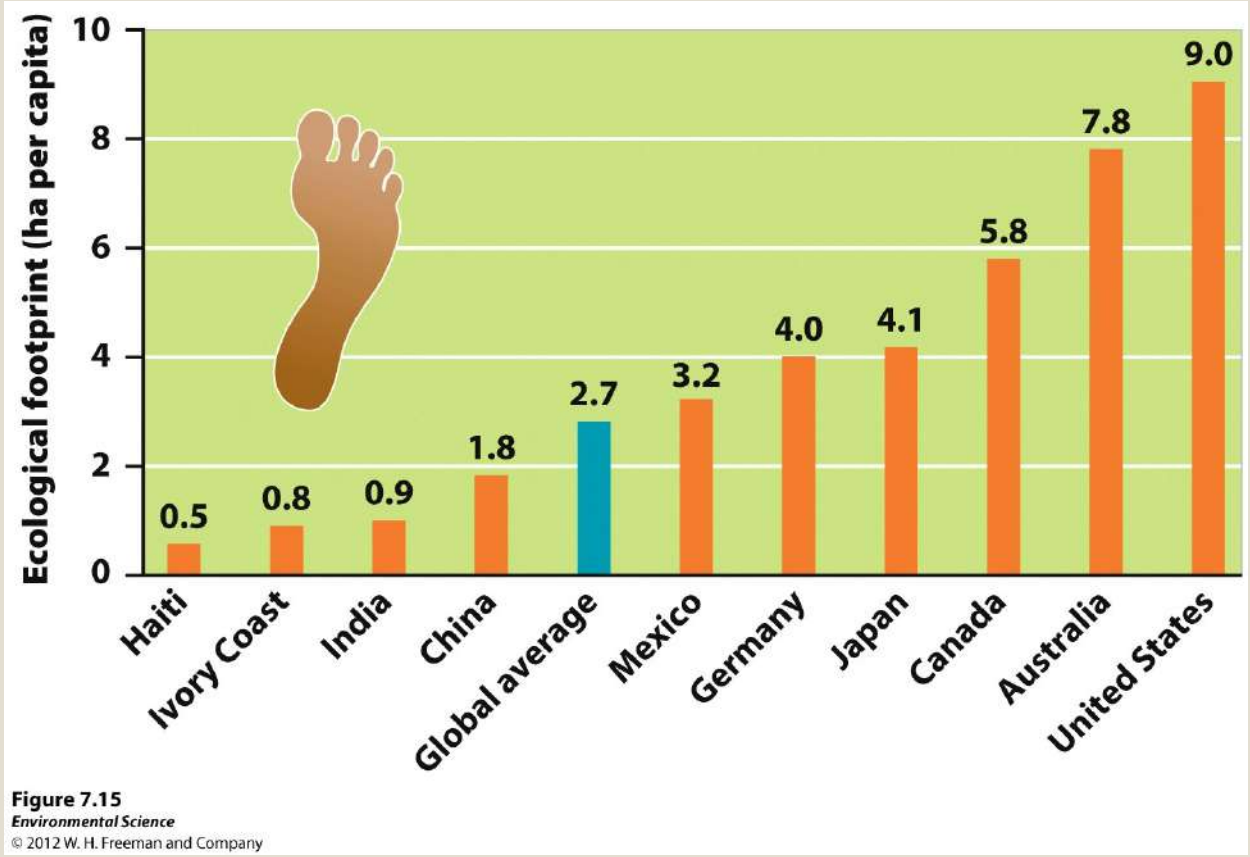


Figure 7.15
Environmental Science

Ecological Footprint

- One person in a developed country can have a greater impact than two or more people in a developing country
- EX) Person living in US has more than 5X the environmental impact of a person living in China
  - 18X that of a person living in Haiti

- World average= 6.7 acres per capita
- US= 22 acres per capita
- China= 4.5 acres per capita
- Haiti= 1.2 acres per capita

IPAT

Impact= Population X Affluence X Technology

- Hard to quantify the total environmental impact of the world:
  - Some people live "green" or unintentionally (poverty)
  - Some people consume large amounts of resources
- Estimates the impact of human lifestyles on Earth
- Representation of the three major factors that influence environmental impact

10/9 Population Review, CH 6 & 7

1. Compare and Contrast a K-selected species and a r-selected species
2. Explain the different survivorship curves.
3. Explain the following countries population based on the age structures:

   (a) India (b) US (c) Germany (d) China

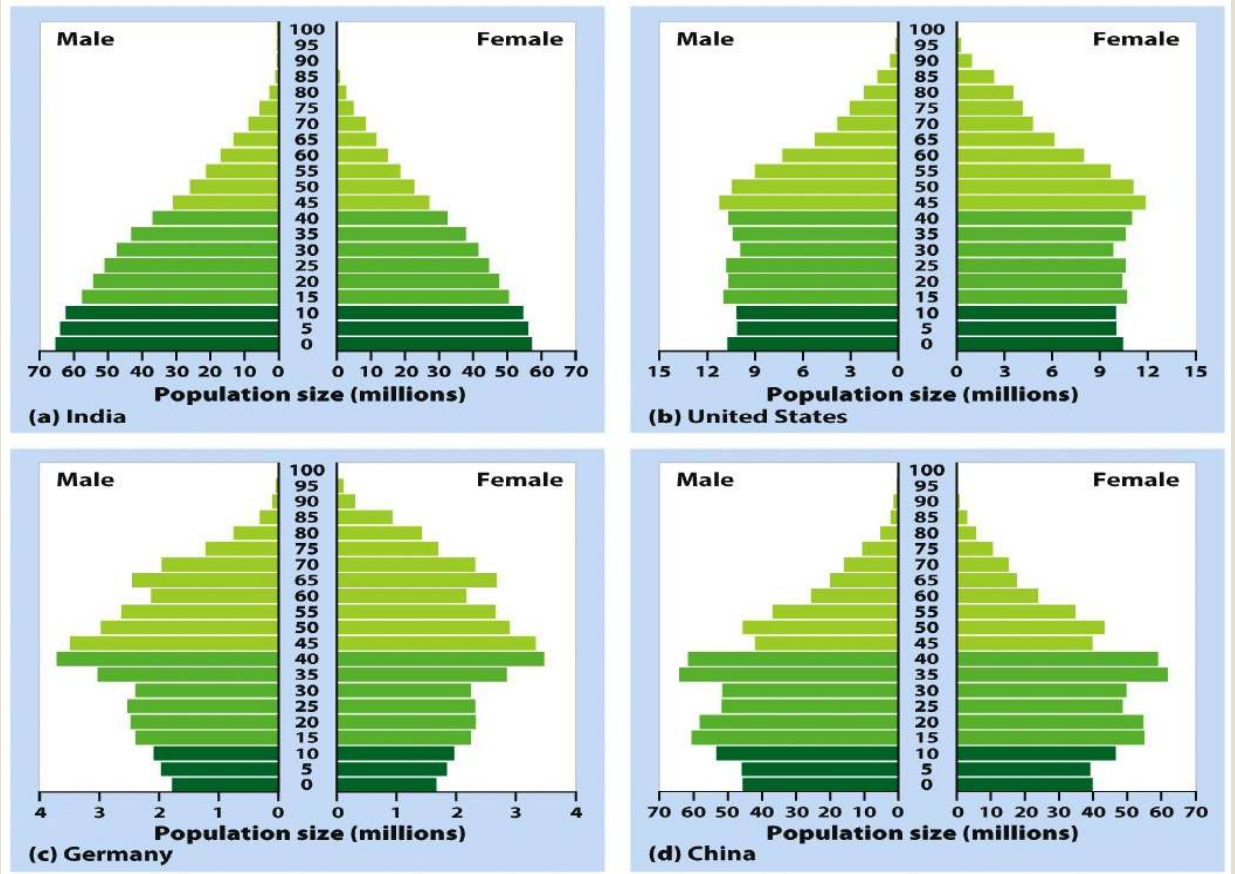


Figure 7.8
Environmental Science

K- selected vs. r-selected

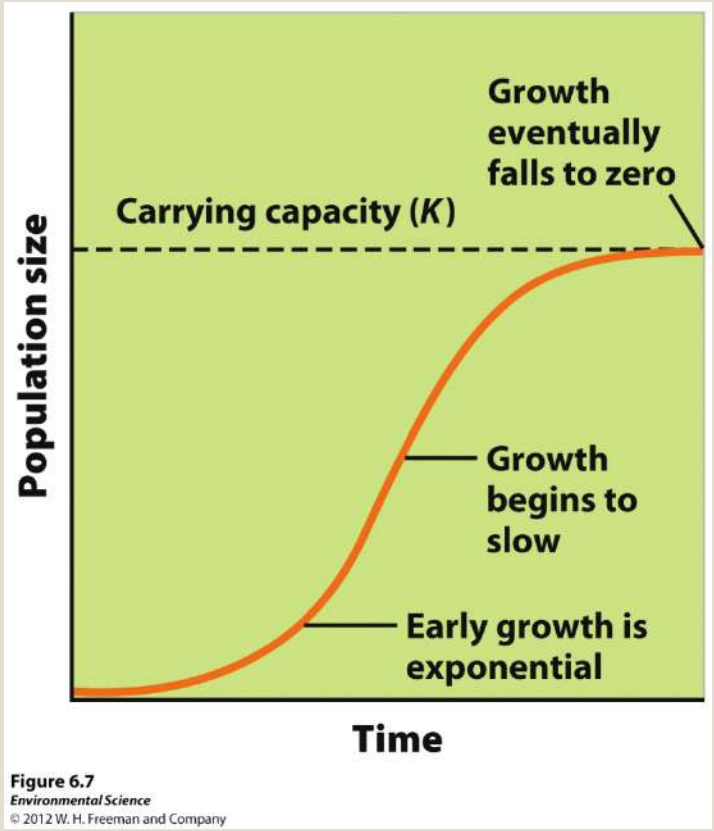
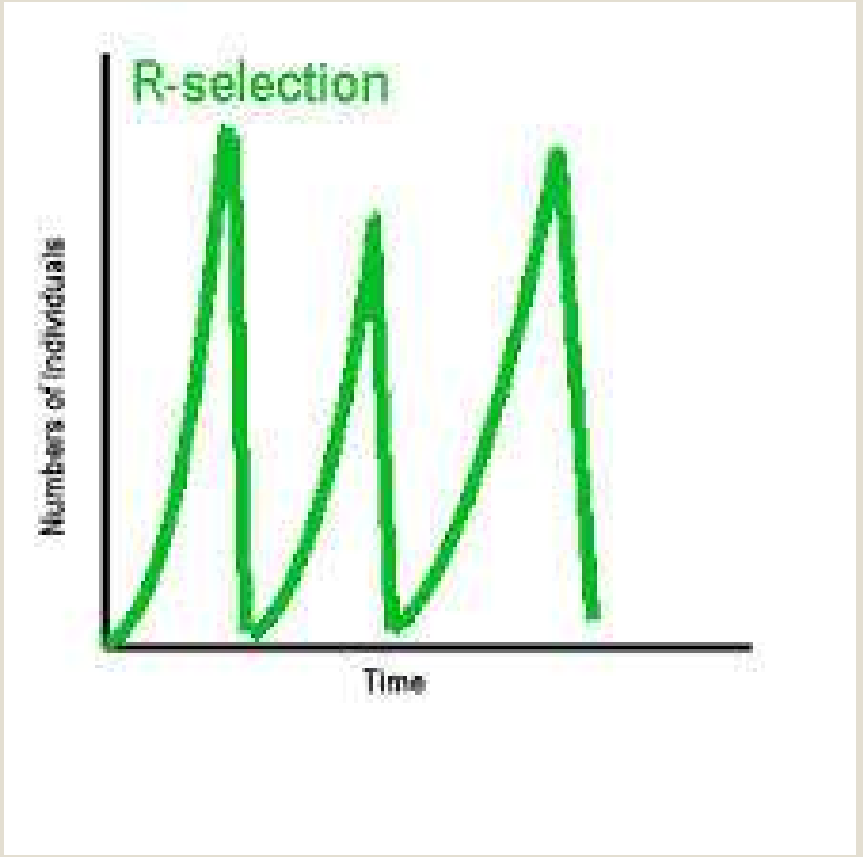


Figure 6.7
Environmental Science



Reproductive Strategies

- **K-selected species-** the population of a species that grows slowly until it reaches the carrying capacity.

Ex. elephants, whales, and humans*.

- **R-selected species-** the population of a species that grows quickly and is often followed by overshoots and die-offs.

Ex. mosquitoes and dandelions

Logistic Growth Model

- Population whose growth is initially exponential, but slows as the population approaches the carrying capacity.
- S-shaped curve- when graphed the logistic growth model produces an "S".
- Usually "K" selected species.

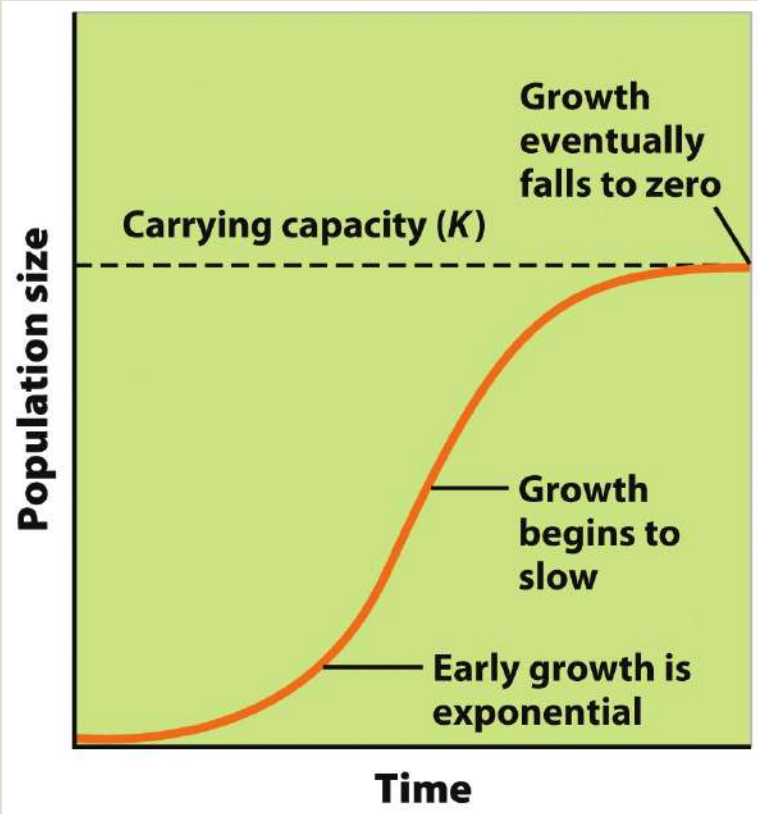


Figure 6.7
Environmental Science

Growth and decline of Reindeer population

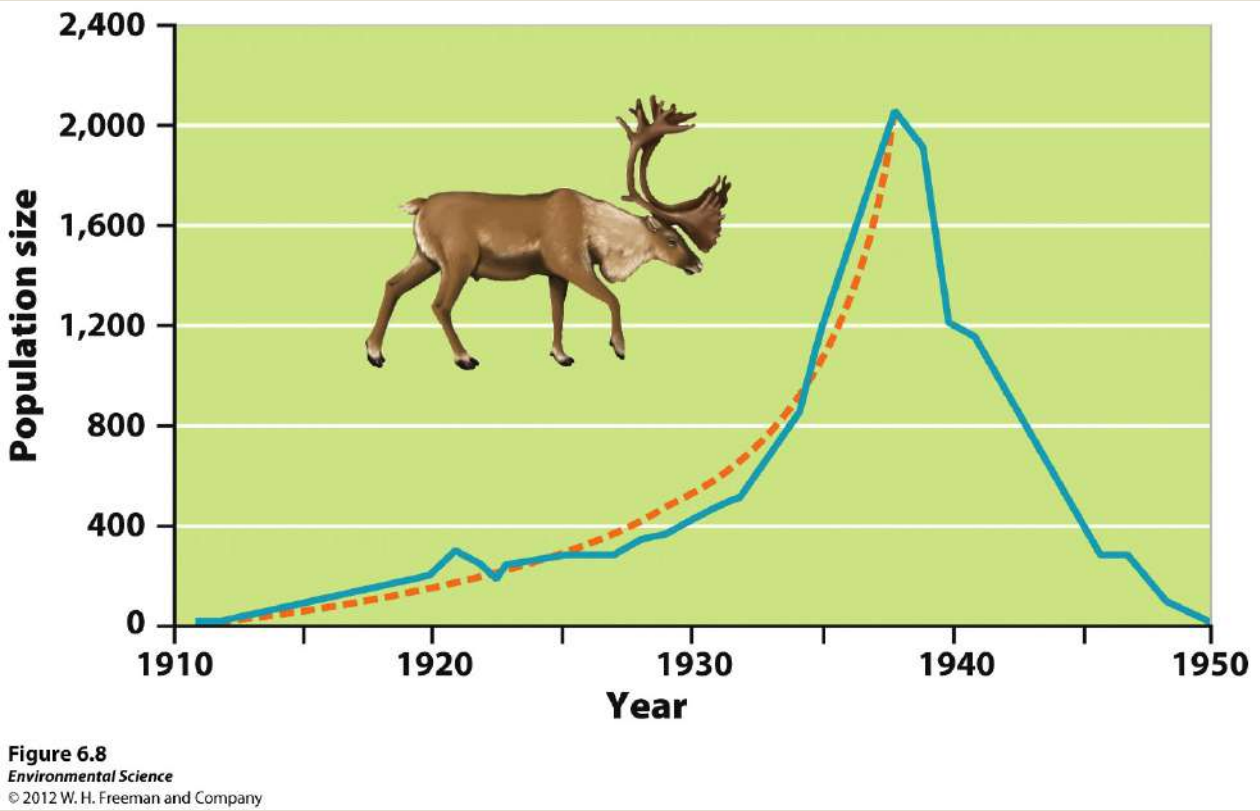


Figure 6.8
Environmental Science

25 Reindeer were introduced to St. Paul Alaska in 1910.

- What Growth pattern does it show?
- Why did the population crash?

TABLE 6.1 Traits of *K*-selected and *r*-selected species

Trait	*K*-selected species	*r*-selected species
Life span	Long	Short
Time to reproductive maturity	Long	Short
Number of reproductive events	Few	Many
Number of offspring	Few	Many
Size of offspring	Large	Small
Parental care	Present	Absent
Population growth rate	Slow	Fast
Population regulation independent	Density dependent	Density
Population dynamics	Stable, near carrying capacity	Highly variable

Table 6.1
Environmental Science

Survivorship Curves

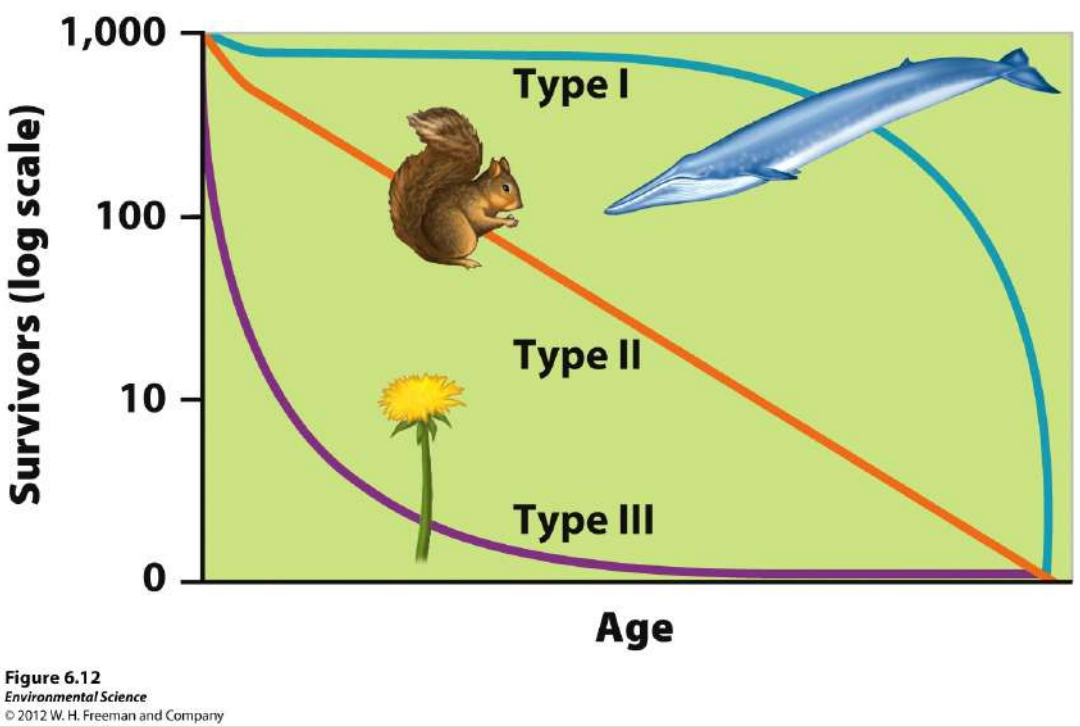


Figure 6.12
Environmental Science

Type I survivorship – Has excellent survivorship until old age. **K – selected species.**

Type II survivorship – Exhibiting a relatively constant decline in survivorship over time.

Type III survivorship – Has low rates of survivorship early in life. **r-selected species**

Age Structure Graphs

- (a) India (2)= (Developing countries) Pyramid shape= **Growing populations**, more births than deaths
- (b) US (3) = Rectangular shape= **Stable**, similar number of individuals in each age group, deaths and births equal each other, slow population growth
- (c) Germany (4)= **Declining populations**, Narrower at the bottom than at the top, more deaths than births
- (d) China**= Early stages of a declining population**→ pop. control

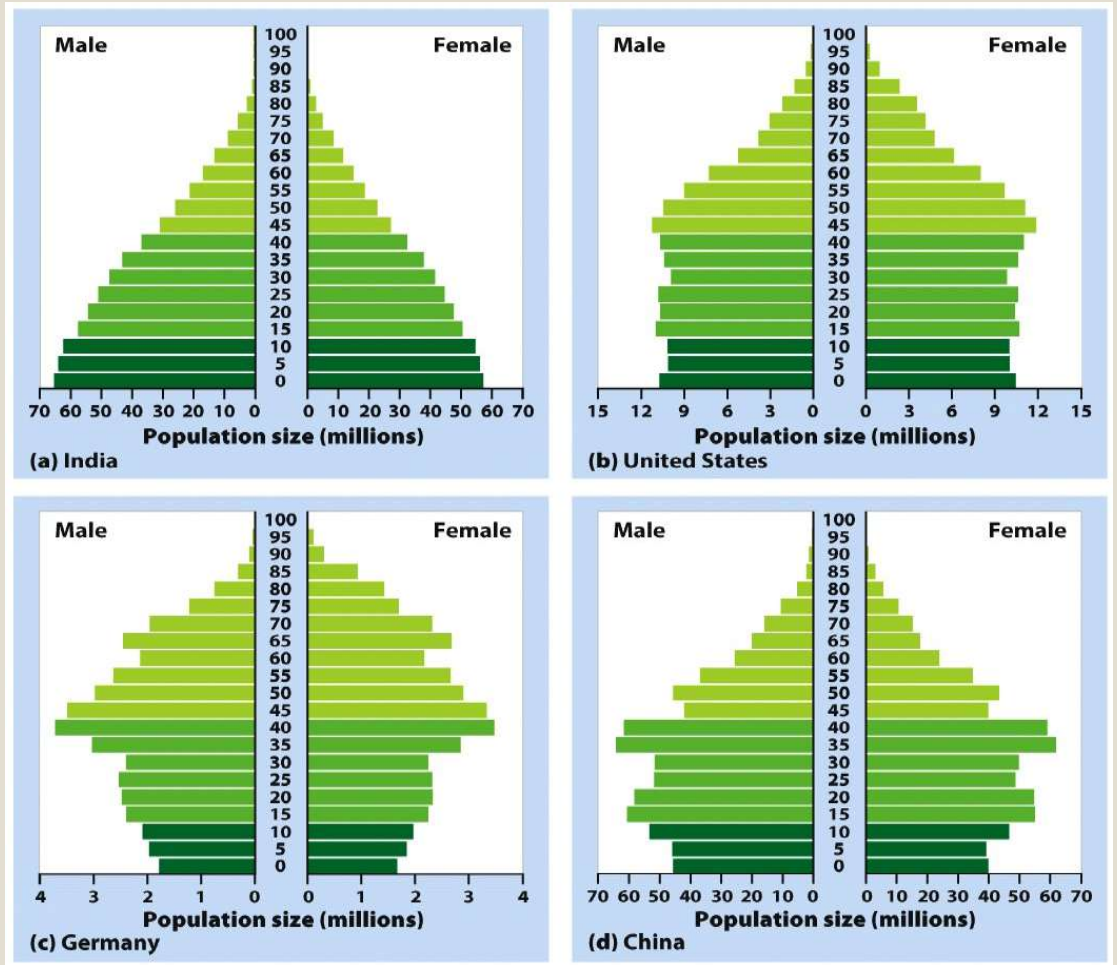


Figure 7.8
Environmental Science

In the News…

- http://www.thedailybeast.com/articles/2014/10/05/glaciers-lose-204-billion-tons-of-ice-in-three-years.html?utm_content=buffer66e36&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer

- **Friday:**
- What are the four stages (Names) of demographic transition?
- Crude birth and death rate
- **Monday: 10/6**
- Population problem (check)
- Relationship between economic development and population
- Explain the different viewpoints scientists have on if humans will reach our carrying capacity or not? Pg. 180-181
- **Tuesday: 10/7**
- Fertility
- Family Planning
- Life Expectancy
- **Wednesday: 10/8**
- Ecological footprint
- IPAT equation
- Impact of Affluence
- **Thursday: 10/9**
- Review of CH 6, CH 7