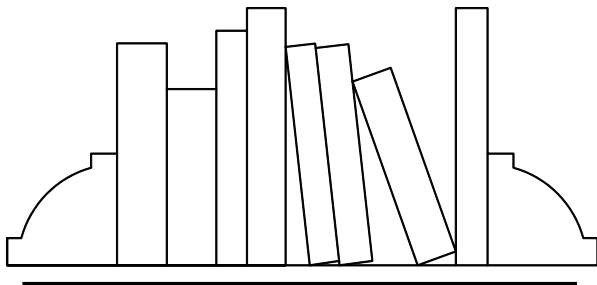


Population Issues

Lecture Outline:

2. POPULATION ISSUES
 - A. Population Biology
 - B. Mechanisms of Population Balance
 - C. Population Growth Curves
 - D. Just Numbers
 - E. Different Worlds
 - F. Consequences of an Exploding Population



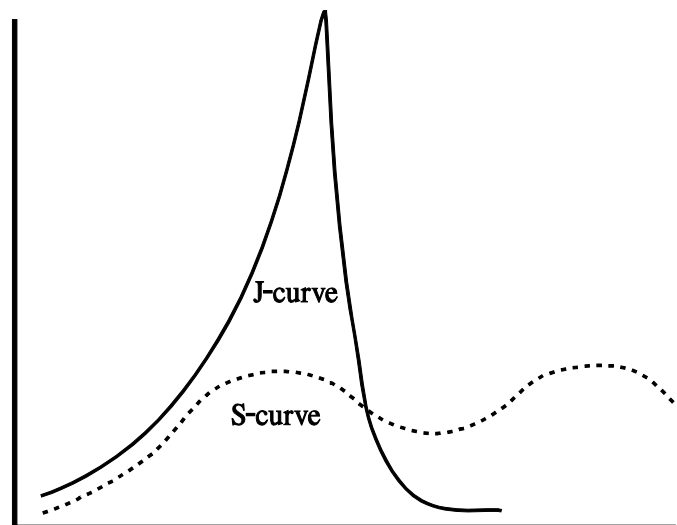
Learning Objectives:

When you are finished with this unit you should be able to:

1. Contrast current population growth rates in LDCs, MDCs and HDCs.
2. Define and give examples of the factors involved in biotic potential and environmental resistance.
3. Describe J-shaped and S-shaped population growth curves.
4. List and describe the consequences of rapid population growth in LDCs.
5. Describe and contrast fertility rates, and future population projections for LDCs, MDCs and HDCs.
6. Based on current data, know which continents are growing fastest, and which are growing slowest.
7. Define megacities and identify the population problems associated with them.

Terms You Should Know:

- ❖ Third World
- ❖ Environmental regard
- ❖ MDCs
- ❖ Emigration
- ❖ Critical number
- ❖ J population curve
- ❖ Exponential increase
- ❖ Replacement level
- ❖ Threatened species
- ❖ Biotic potential
- ❖ Carrying capacity
- ❖ Environmental resistance
- ❖ Endangered species
- ❖ Population explosion/momentum
- ❖ Total fertility rate
- ❖ HDCs
- ❖ LDCs
- ❖ Immigration
- ❖ S population curve
- ❖ Reproductive rate
- ❖ Population
- ❖ Density dependence
- ❖ Recruitment
- ❖ Territoriality



Reading Assignment:

Brennan and Withgott: Chapter 3; pages 50-75.

2. POPULATION ISSUES

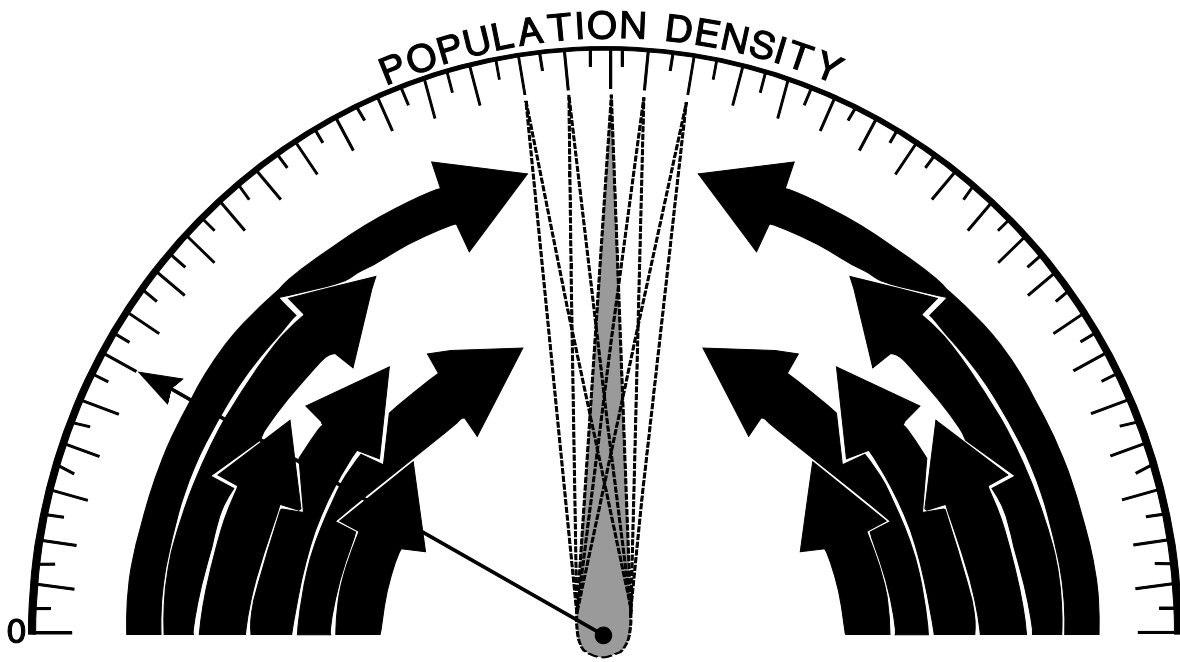
A. POPULATION BIOLOGY

- All relationships in an ecosystem are in dynamic balance
- Each species in an ecosystem exists as a **POPULATION**
- **POPULATION**—an interbreeding, reproducing group
- For an ecosystem to remain stable, populations remain more or less constant in size and geographic distribution

1. Biotic Potential VS Environmental Resistance

BIOTIC POTENTIAL of a species consists of a number of factors:

- **REPRODUCTIVE RATE**—number of live births, eggs laid, seeds, spores, etc
- **RECRUITMENT**—making it through early growing stages to become part of the reproducing population
-
-
-
- **Resistance** to adverse conditions and disease



Biotic Potential

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-
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-
-
-

Environmental Resistance

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-
-
-
-
-

Species have the ability to rapidly reproduce if conditions are right:

10 - 100 - 1000 - 10000 — **EXPONENTIAL INCREASE**

EXPONENTIAL INCREASE = POPULATION EXPLOSION

- One or more abiotic factors may become limiting; combination of biotic and abiotic factors to limit population increase is called **ENVIRONMENTAL RESISTANCE**

ENVIRONMENTAL RESISTANCE—

RECRUITMENT varies widely:

REPLACEMENT LEVEL—recruitment just enough to replace adults—population remains constant

2. Density Dependence and Critical Numbers

- As **POPULATION DENSITY** (the number of individuals per unit area) increases
→ **ENVIRONMENTAL RESISTANCE** becomes more intense

EXAMPLE:

Rabbits in Australia, with a new disease

Rabbits (sq mile)	Deaths	Death Rate
50	5	10%
500	100	20%
5,000	4,500	90%*

* Population stops growing

- **CRITICAL NUMBER**—
- If population drops below the **CRITICAL NUMBER**—biotic potential fails →
- Species whose populations are declining because of human activity are called **THREATENED**
- If species population decline is great and believed to be approaching the **CRITICAL NUMBER**—defined as **ENDANGERED**

B. MECHANISMS OF POPULATION BALANCE

1. Predator-prey and Host-parasite Relationships

EXAMPLES: Predator-prey

Western USA →

- deer numbers explode
-

Lynx-hare relationship in Canada

- low hare population:
 -
 -
 -
- high hare population:
 -
 -
 -

2. Territoriality

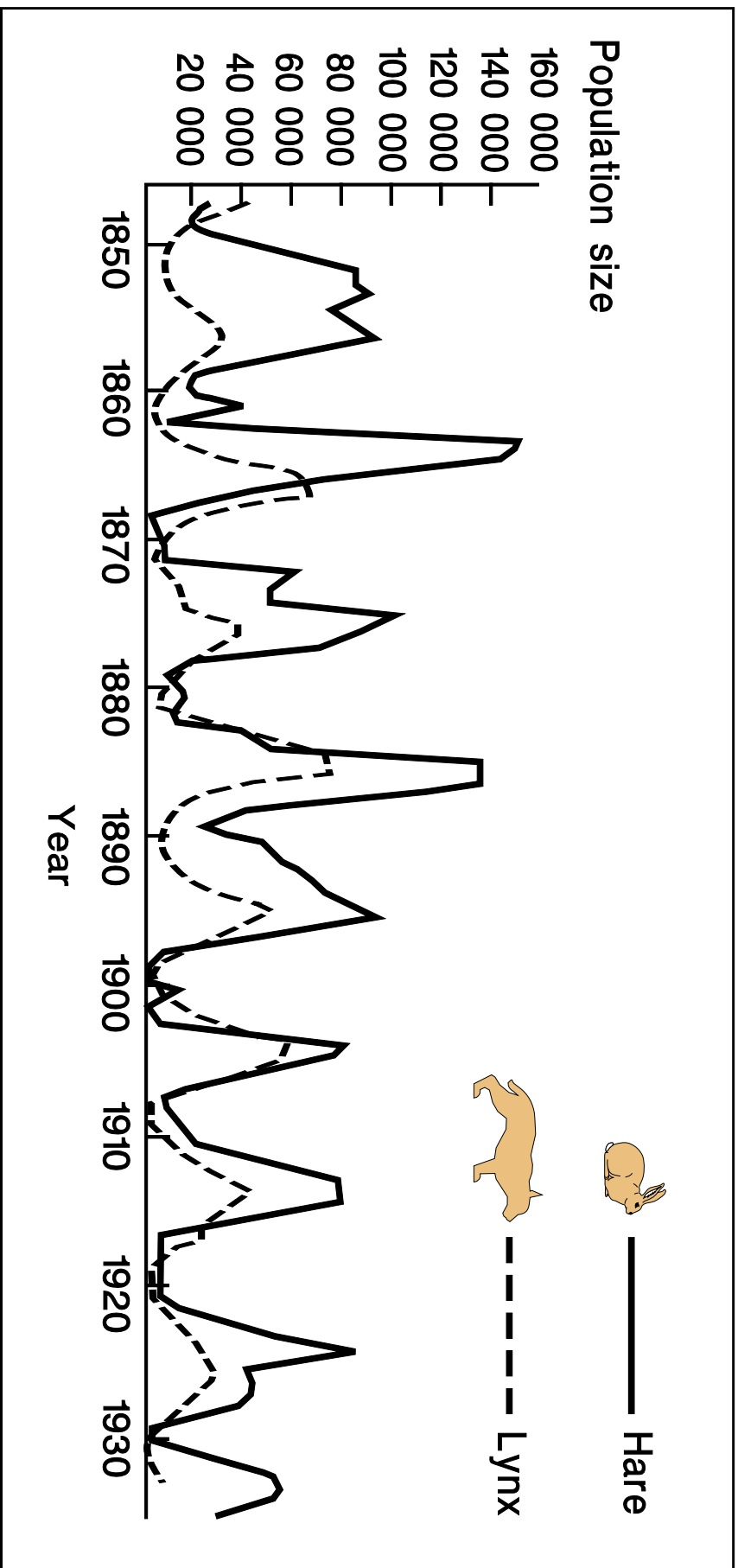
TERRITORIALITY—individuals or group claiming a territory and defending it against others of the same species

- the defended territory is often large enough to assure owners of being able to gather adequate food

EXAMPLES:

- Wolves—urine as territory markers; will kill other wolves, dogs and coyotes to keep territory
 -
- Blue jays, mockingbirds, song birds

CARRYING CAPACITY—the maximum population of an animal that a given habitat will support without the habitat being degraded over the long term



C. POPULATION GROWTH CURVES

- When population is plotted over time there are two types of curves

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–

1. J-shaped Curve



J CURVE—in absence of natural enemies, exponential growth continues until overgrazing results in a precipitous die off of the population due to famine and malnutrition

EXAMPLE:

In about 1900 moose came to Isle Royal National Park

- no wolves as predators

-

- food supply exhausted

-

2. S-shaped Curve



S CURVE—effective natural enemies keep population in balance, well within the carrying capacity of the system

- the dynamic population balance may continue indefinitely
-

D. JUST NUMBERS

- Human population has grown at an explosive rate over the last 200 years
-
- Population did not reach 1,000,000,000 until 1830

Cause of population increase:

advances in

—

—

—

—

- Historical and projected population growth:

Year	Population in billions	Years to add 1,000,000,000	Addition per year (million)
10 BC	0.2		
1500	0.4		
1830	1.0		
1930	2.0		
1960	3.0		
1975	4.0		
1987	5.0		
1999	6.0		
2013	7.0		
2028	8.0		
2048	9.0		
2088	10.0		

- Current population — July 17, 2012

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Current World Growth—2012

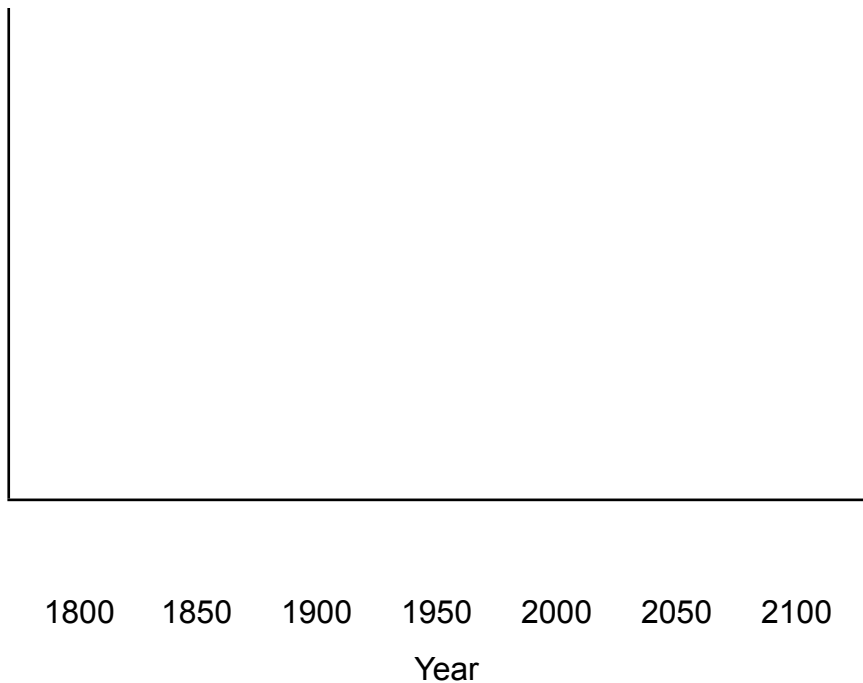
Parameter	Population Growth
Year	
Minute	
Second	

Web Sites to Visit:

- Population.com
 - Contains relevant articles on current and future population issues
 - <http://www.population.com/>

- United Nations Population Information Network
 - Lots of good data
 - <http://www.un.org/popin/>
- U.S. POPClock Projection
 - The population for the U.S. projected for each day
 - <http://www.census.gov/population/www/popclockus.html>
- World POPClock Projection
 - World population projected each day
 - <http://www.census.gov/ipc/www/popclockworld.html>
- Population Pyramids
 - Good data on 200 countries
 - <http://www.census.gov/ipc/www/idb/pyramids.html>

Human population J curve:



World Population (millions)

	1950	2012	2050
WORLD	2,516	7,000	8,919
AFRICA	222	980	1,803
NORTH AMERICA	172	352	448
SOUTH AMERICA	167	590	768
ASIA	1,398	3,900	5,222
EUROPE	547	800	632
OCEANIA	13	36	46
USA	152	312	395
IDAHO	0.6	1.5	4.4

(From: United Nations Population Division; World Population Prospects — The 2002 Revision)

Projections to 2050:

- In 2003 the UN revised the 2050 estimate downward from 9.3 to 8.9 billion
- Downward revision due to:
 -
 -
- Four 2050 projections actually exist
 - Constant:
 - High:
 - Medium:
 - Low:
- Africa based on projections
 - Constant:
 - High:
 - Medium:
 - Low:

Current population growth

2010:

2010:

HDC's

MDC's

LDC's

E. Different Worlds

1. Rich Nations, Poor Nations

3 categories of countries in the world:

a. High income, highly developed

-

- USA, Canada, Japan, Western Europe, Australia, Scandinavia and Finland

-

b. Middle income, moderately developed

-

- Latin America, Northern Africa, East Asia, former USSR, Eastern Europe, Coastal China

-

c. Low income, undeveloped

-

- East, West, and Central Africa; Indian subcontinent; Interior China; Southeast Asia

-

- Breaking down by income:

Country	Per capita income
HDC	
MDC	
LDC	

- Currently:

HDC's:

MDC's:

LDC's:

2. Different Population Problems

-

TOTAL FERTILITY RATE—average number of children each woman has over her lifetime

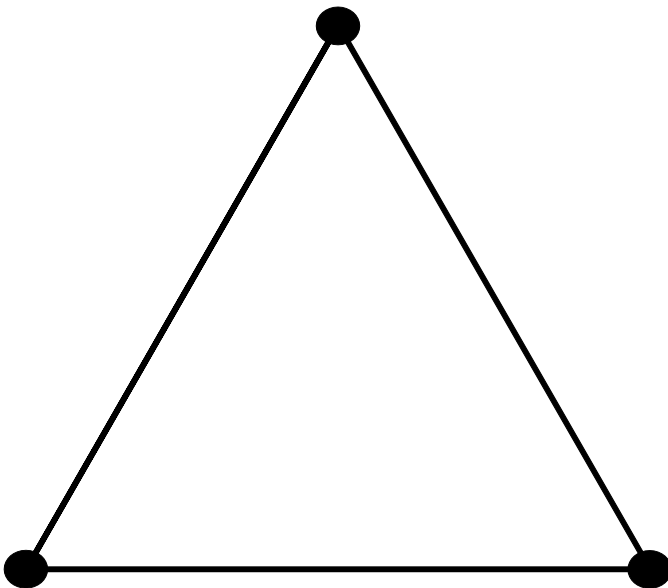
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THREE RELATED FACTORS:

-

-

-



=

Negative
Env. Impact

Population X Lifestyle

Environmental Regard

F. CONSEQUENCES OF AN EXPLODING POPULATION

1. Population and Poverty

- Population growth, poverty and environmental degradation are entwined

a. Country-side:

- Each generation is much larger

- 3 alternatives:

i. Subdivide farms, as generations pass, less land than elders had:

25 acres

ii. Extra people from each generation can seek new land to farm, or intensify cultivation of existing farmland

iii.

iv.

b. Cities

-
- City services can not keep pace
 - sanitation
 - water
 - schools
-

Rural to Urban Transformation

- What is urban?
 -
- Urban population
 - 2000:
 - 2030:
 -

Fast Urban Transformation Since 1960

Year	% Urban
1000 AD	
1800	
1900	
1950	
2005	
2020	
2050	

MEGACITIES

- Cities with more than 10,000,000 people

Year	Megacities
1950	
1975	
2000	
2015	
2030	

c. Women and Children

-
- Lock poor into cycle of illiteracy and absolute poverty

d. Emigration/Immigration

- Historically, Europe's overflow to Americas and Australia
-

2. Population and Affluence

-

a. Affluence and Global Population

-
- increased consumption
- CO₂, global warming, nuclear wastes, hazardous wastes, ozone depletion, etc
-

b. Pressure on Land

- development
-
-

How can we live gently?