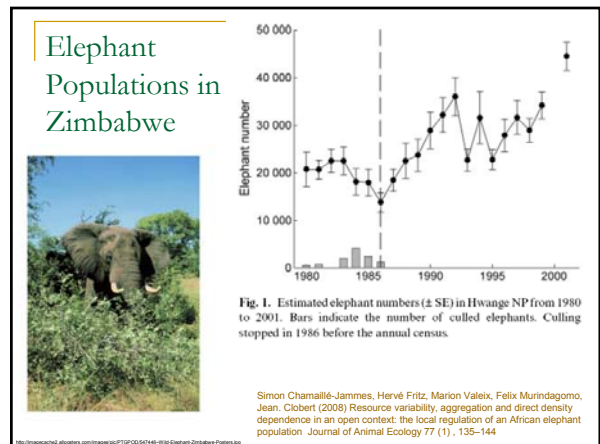
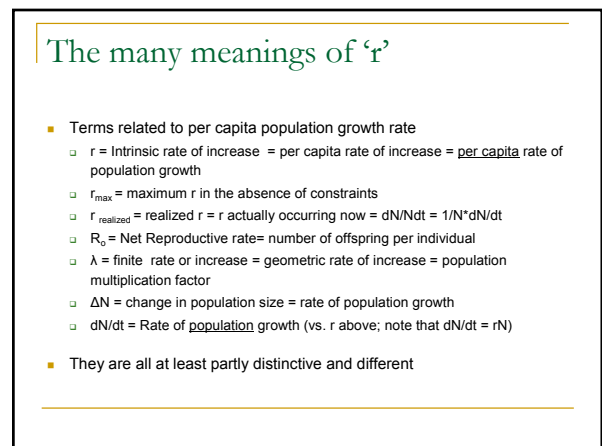
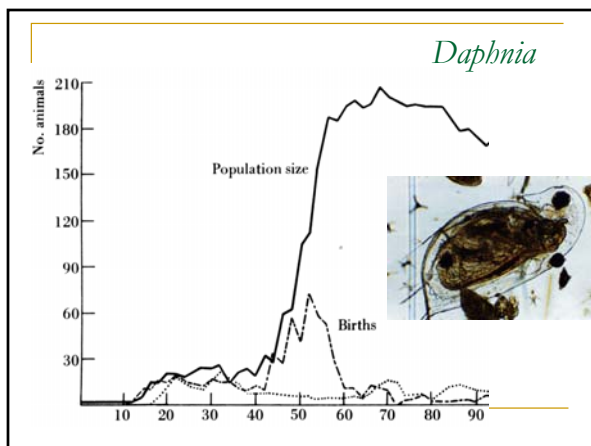
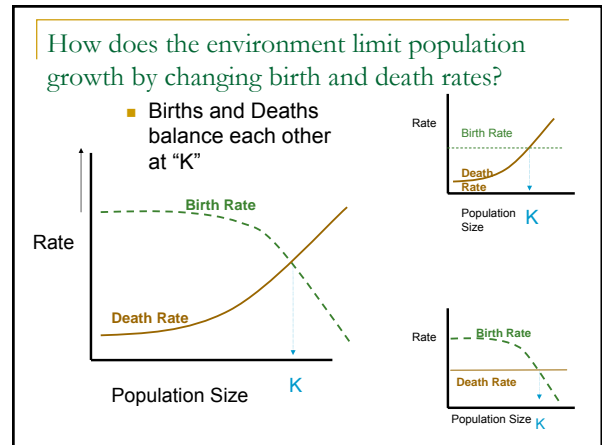
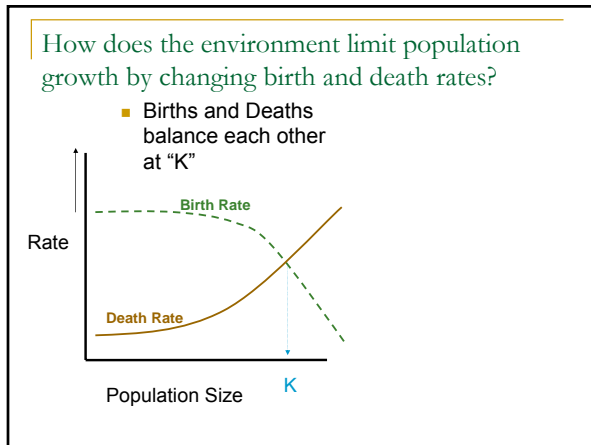
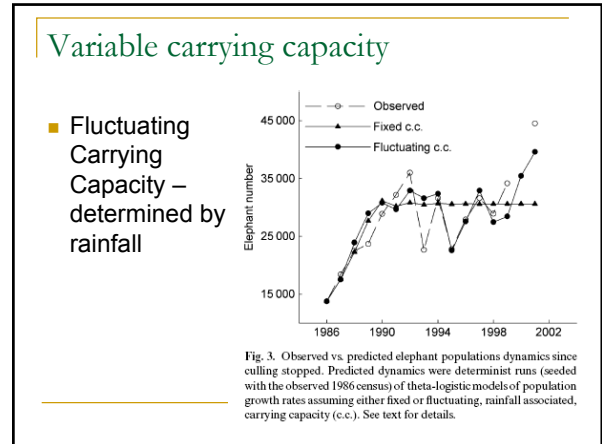
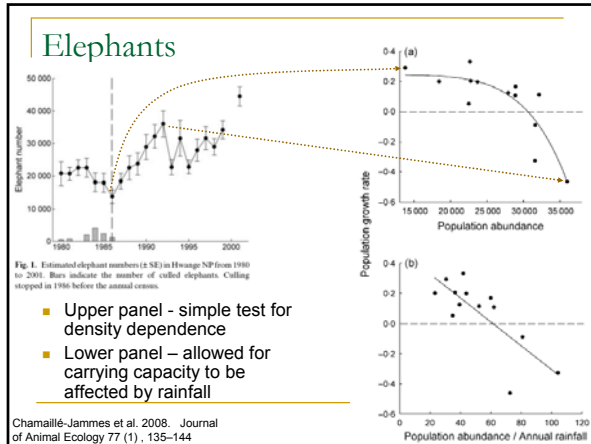


### Density-Dependent vs. Density-Independent?

- Book oversimplifies this
- Density Dependent:
  - Growth rate is higher at low density
  - Growth rate is less at high density
  - Often biotic factors
    - Resource limitation (within or between species competition)
    - Predation
    - Behavior (movement away or towards)
  - Also some biotic factors
    - Hiding places....
- Density Independent:
  - Growth rate does not vary predictably with density
  - Often abiotic factors
    - Drought
    - Freeze
    - Hurricane
    - Floods....
  - Also some biotic factors
    - Diseases that kill all, regardless of density
    - Variation in food supply due to variation in weather
    - Variation in habitat or nesting sites due to storms

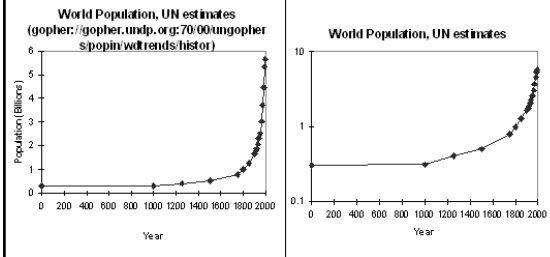




## Human Population Growth

- General
- Why has  $r$  for humans declined recently?  
What is  $K$  for humans?
- See next presentation

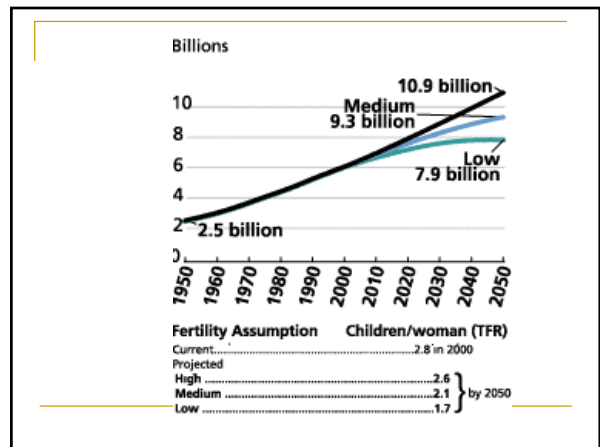
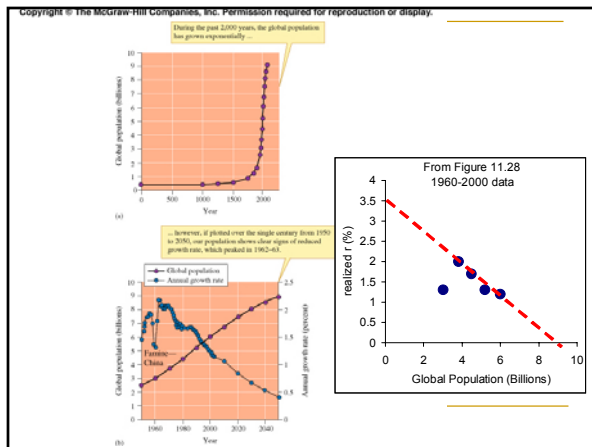
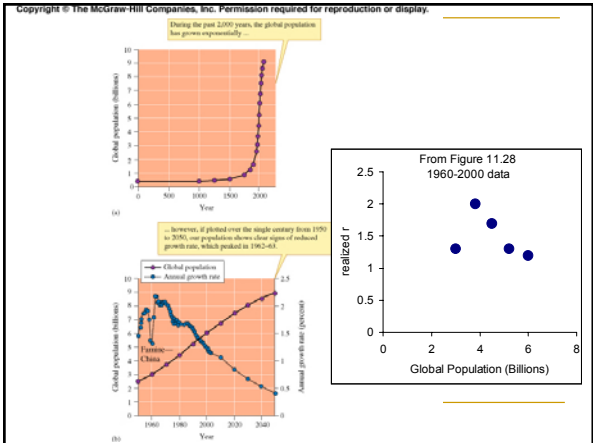
## Human Population Growth



How long can this rate of growth be sustained?

## Doubling times across the globe

Continent	$r$	Doubling time
Africa	0.029	24 yr
South America/Caribbean	0.020	35 yr
North America	0.007	98 yr
Asia	0.017	41 yr
Europe	0.001	1025 yr
Oceania	0.012	57 yr

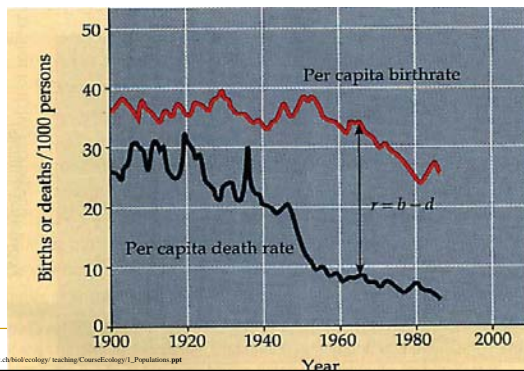


How can human populations be limited?

How can human populations be limited?

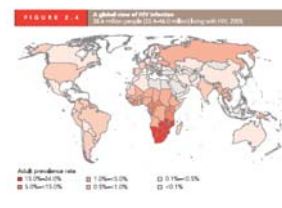
- Ultimate causes:
  - Increase deaths
  - Reduce births
  - (we'll ignore immigration and emmigration for now – focus on global human population)
- Proximate causes- How can birth and death rates be changed?

### Global Human Population



### AIDS as a factor reducing population

World region	Adult HIV prevalence (ages 15-49)	Total HIV cases	AIDS deaths in 2005
Sub-Saharan Africa	6.1%	24.5m	2.0m
Worldwide	1.0%	38.6m	2.8m
North America	0.8%	1.3m	27,000
Western Europe	0.3%	720,000	12,000



Regional comparisons of HIV in 2005 (Source: UNAIDS, 2006 Report on the global AIDS epidemic)

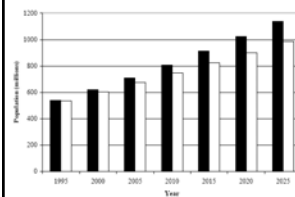
### AIDS in Sub-Saharan Africa

- 24.5 million people here are living with HIV (64% of all people living with the disease)
- 60% or more of those are women
- 90% of the worlds children living with HIV (~2 million) live here



[http://data.unaids.org/pub/GlobalReport/2006/2006\\_GR\\_CH02\\_en.pdf](http://data.unaids.org/pub/GlobalReport/2006/2006_GR_CH02_en.pdf)  
[http://data.unaids.org/pub/GlobalReport/2006/200605-ft\\_subsaharanfrica\\_en.pdf](http://data.unaids.org/pub/GlobalReport/2006/200605-ft_subsaharanfrica_en.pdf) [http://en.wikipedia.org/wiki/Sub-Saharan\\_Africa](http://en.wikipedia.org/wiki/Sub-Saharan_Africa)

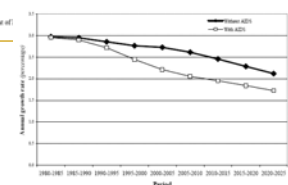
Figure 2. Estimated and projected population size with and without AIDS, 38 African countries, 1995-2000 to 2020-2025



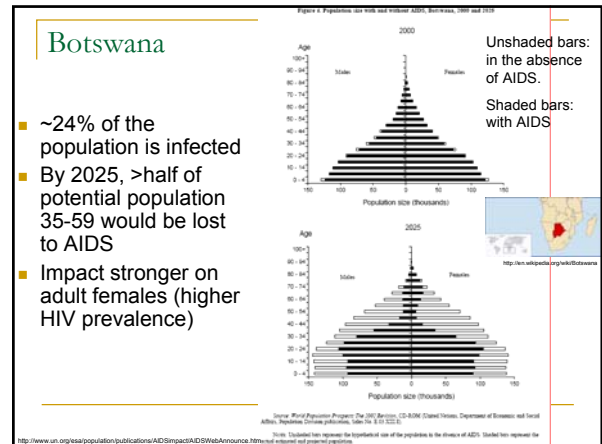
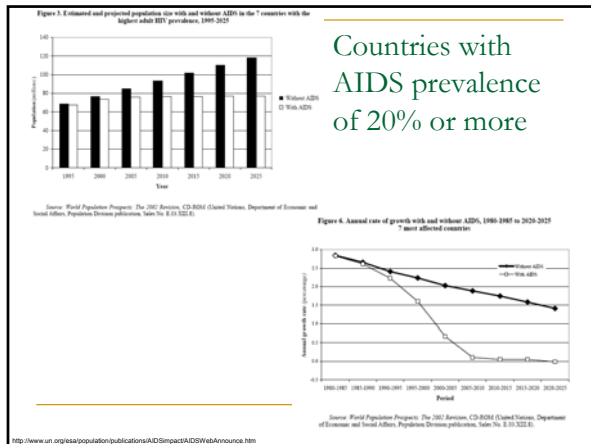
Source: World Population Prospects: The 2002 Revision, CD-ROM (United Nations, Department of Economic and Social Affairs, Population Division, publication, Sales No. 02/5322, E).

### Sub-Saharan Africa

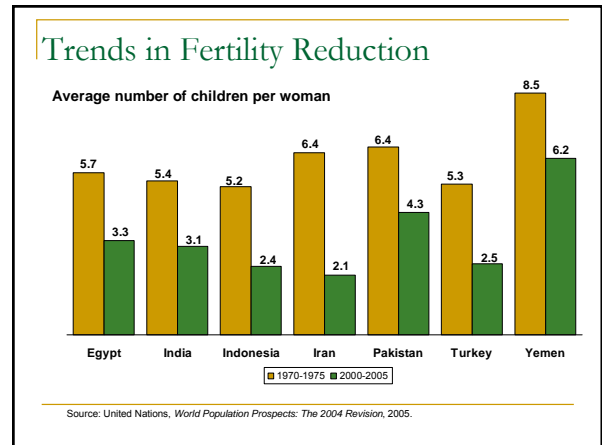
Figure 5. Annual growth rate with and without AIDS, 1980-1985 to 2020-2025, 38 African countries



Source: World Population Prospects: The 2002 Revision, CD-ROM (United Nations, Department of Economic and Social Affairs, Population Division, publication, Sales No. 02/5322, E).



**Reduce births?**



**What actions help control human populations by affecting birth and death rates?**

- Education
- Health Care
- Wealth
- Empower women
- Family planning