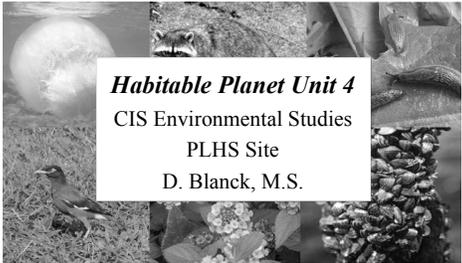


Ecosystems

- Part 2 -



Habitable Planet Unit 4
 CIS Environmental Studies
 PLHS Site
 D. Blanck, M.S.

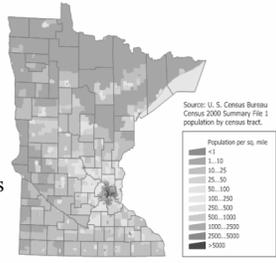
Population

- ♦ **Population:** individuals of a species that live together and naturally reproduce.




Population Features

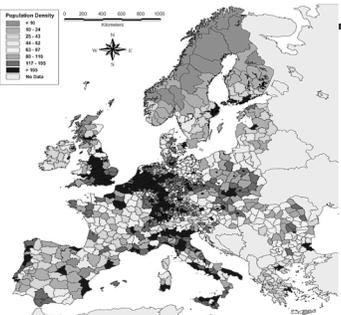
- ♦ # of individuals in a pop. is its **size**.
- ♦ # of individuals living in an area is the **density**.
- ♦ The arrangement of individuals in a pop. is its **dispersion**.



Source: U.S. Census Bureau Census 2000 Summary File 1 population by census tract.

Population per sq. mile
< 1
1-10
10-25
25-50
50-100
100-250
250-500
500-1000
1000-2500
2500-5000
> 5000

Population Features

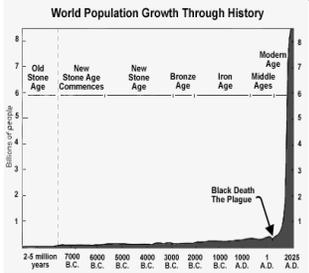


Population Density

< 10
10-24
25-50
51-100
101-200
201-500
501-1000
> 1000
No Data

Population Growth

- ♦ Populations grow **exponentially**.
- ♦ Population an environment can sustain is its **carrying capacity (K)**



World Population Growth Through History

2.5 million years, 7000 B.C., 6000 B.C., 5000 B.C., 4000 B.C., 3000 B.C., 2000 B.C., 1000 B.C., 1000 A.D., 1 A.D., 2025 A.D.

Population Growth



POPULATION GROWTH
Change of population 2007 in percent

Allianz @

decrease
increase: +0-1%
+1-2%
+2-3%
+3-5%

Source: U.S. Census Bureau, International Data Base
For further information please visit: www.knowledge.allianz.com

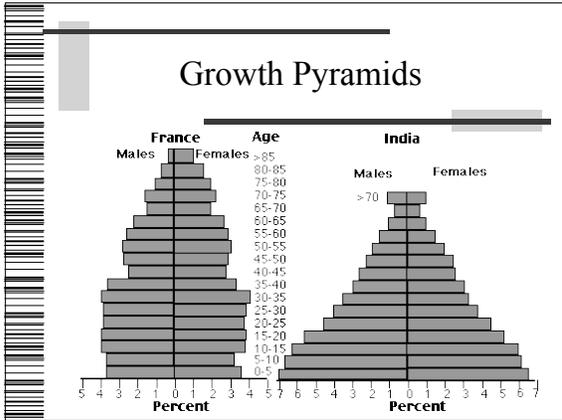
Population Growth Models

- ◆ Growth Rate (aka Reproductive Rate)
 - $R = \text{birthrate} - \text{deathrate}$
- ◆ Exponential* Population Growth Formula
 - $N_t = R^t \cdot N_0$

* Logistical Growth is limited by the Carrying Capacity (K)

Year	Birth Rate	Death Rate
1901-11	45	35
1911-21	44	34
1921-31	43	33
1931-41	42	32
1941-51	41	31
1951-61	40	30
1961-71	39	29
1971-81	38	28
1981-91	37	27
1991-96	36	26
1996-2001	35	25

Source: Registrar General India



Population Control

- ◆ Density dependent factors
 - Food
 - Water

Population Control

- ◆ Density independent factors include
 - Rainfall
 - Temperature

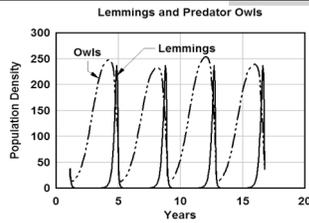
Life History Strategy

- ◆ An organism's allocation of energy throughout its lifetime among three competing goals: growing, surviving, and reproducing.

Life History Strategies

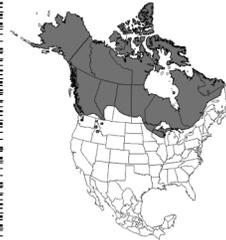
- ◆ Rapid population growth in good conditions
 - (r-selected)
- ◆ Slow growth
 - (K-selected)

Lemmings as an r-selected species



The lemming is the smallest mammal in the Arctic. It is a main source of food for predators such as owls. Lemming populations rise and fall dramatically, peaking about every 4 yrs and then dropping to near extinction.

Wolves as a K-selected species



Hunted to near extinction across the northern hemisphere, the range of the Timber or Gray Wolf is now Canada, MN, WI and the UP. Wolves are also found in Idaho and have been successfully re-introduced in Yellowstone NP.



Yellowstone Wolf Video

Symbiosis

A long term relationship between two species



Parasitism

One organism feeds on (and usually lives in or on) another. The host is harmed.



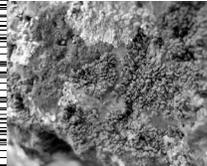
Mutualism

Both species benefit



Commensalism

One organism benefits. The other is neither helped nor harmed



Niche/Habitat

- ♦ A **niche** is the "role" that a species plays in their community.
- ♦ A **habitat** is the place where an organism lives out its life.



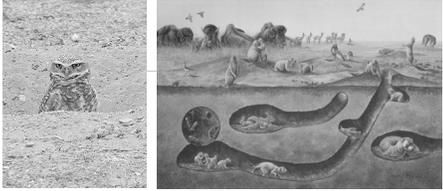
Keystone Species

- ♦ A species that occupies a vital ecological niche.
- ♦ Eg: black-tailed prairie dogs impact the prairie ecosystem in multiple ways:



- ♦ *Their burrows act as homes to other creatures, including burrowing owls, badgers, rabbits, black-footed ferrets, snakes, salamanders, and insects.*
- ♦ *Their burrowing activity works to loosen and churn up the soil, increasing its ability to sustain plant life.*
- ♦ *Their foraging and feeding practices enable a more nutritious, diverse and nitrogen-rich mixture of grasses and forbs (broad-leafed vegetation) to grow, in turn attracting an amazing array of wildlife.*

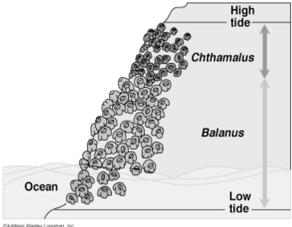
- ♦ *Black-tailed prairie dogs play an integral role in the prairie food chain; they are a critical food source for such animals as the endangered black-footed ferret, swift fox, coyotes, hawks, eagles and badgers.*



Fundamental and Realized Niches

- ♦ **Fundamental niche:** the full range of environmental conditions (biotic and abiotic) under which an organism could exist.
- ♦ **Realized niche:** the ecological role an organism plays when constrained by the presence of other competing species.

Competitive exclusion principle



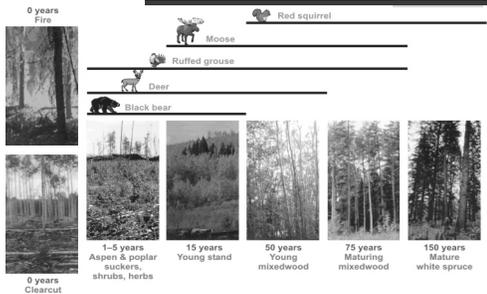
- ♦ If two competitors try to occupy the same niche, one species will be more successful and exclude the other.

Succession

- ♦ Predictable progression of species replacement.
- ♦ **Primary:** New Habitat
- ♦ **Secondary:** Disturbed Habitat



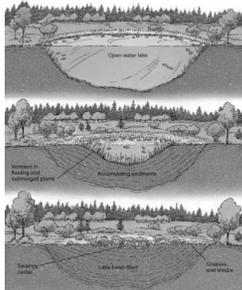
Forest Succession



Time	Species
0 years	Fire
0 years	Clearcut
1-5 years	Aspen & poplar suckers, shrubs, herbs
15 years	Young stand
50 years	Young mixedwood
75 years	Maturing mixedwood
150 years	Mature white spruce

Animals shown: Black bear, Deer, Ruffed grouse, Moose, Red squirrel.

Lake Succession



- ◆ Small “kettle” lakes will naturally transition from Oligotrophic to Eutrophic and eventually to boggy meadows over time