Changing Population Sizes

Four variables affect changes in population sizes...

1. births
2. deaths
3. **immigration** - act of entering a nation
4. **emigration** - act of leaving a nation

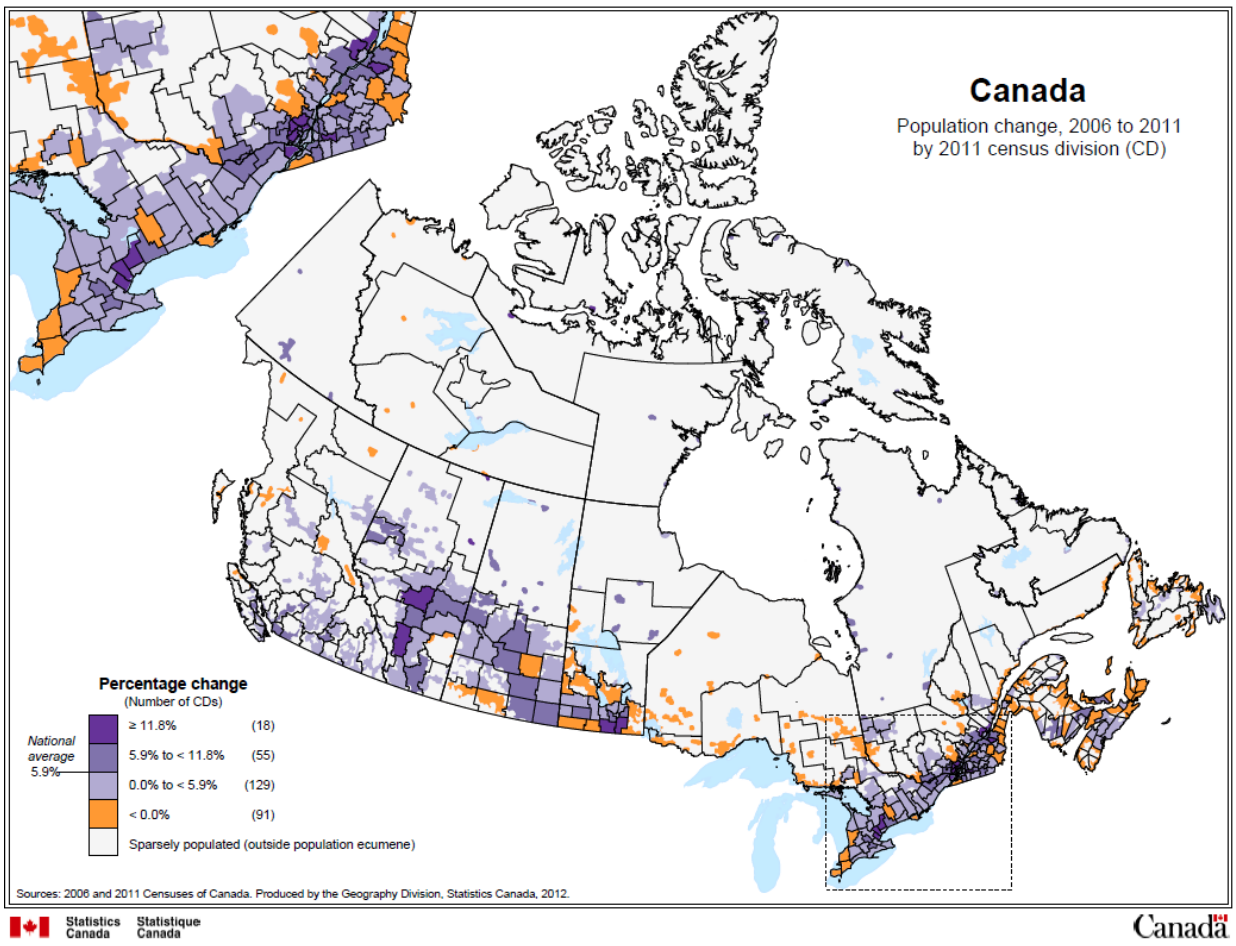
[A person emigrates **from** Germany and then immigrates **to** Canada.]

population change rate = (births + immigration) - (deaths and emigration)

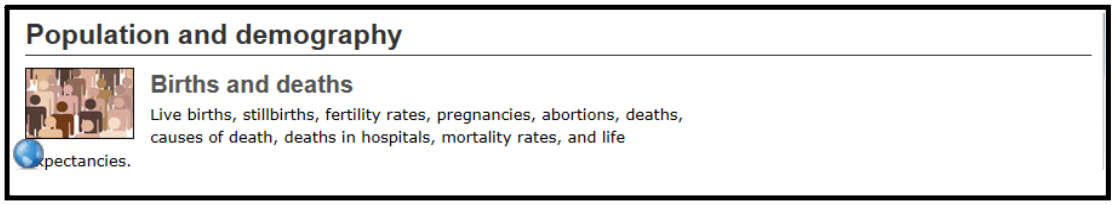
gains in population

declines in population

The term "**population growth**" refers to how the number of individuals in a population increases (or decreases) with time.


Canada
Population change, 2006 to 2011
by 2011 census division (CD)
Percentage change
(Number of CDs)
National average 5.9%
≥ 11.8% (18)
5.9% to < 11.8% (55)
0.0% to < 5.9% (129)
< 0.0% (91)
Sparsely populated (outside population ecumene)
Sources: 2006 and 2011 Censuses of Canada. Produced by the Geography Division, Statistics Canada, 2012.
Statistics Canada Statistique Canada
Canada

Let's look at some STATS from...



Calculating Exponential Growth

Formula for Exponential Growth

A quantity A that has exponential growth can be modeled by

$$A = P(1 + r)^n$$

- A measures the quantity at any time.
- P is the initial value of A, when $n = 0$.
- r is the rate (%) of growth, *in decimal form.*
- n is the elapsed time.

http://www.math.andyou.com/pdf/152.pdf

http://www.math.andyou.com/152

EXAMPLE: The growth rate of a bacteria culture is 52% each hour. Initially, there are two bacteria. How many bacteria are there after 12 hours?

÷ 100

$A = P(1+r)^n$

$A = 2(1+0.52)^{12}$

A = ?
P = 2
r = 0.52
n = 12

```
2(1.52)^12
        304.1956862
```

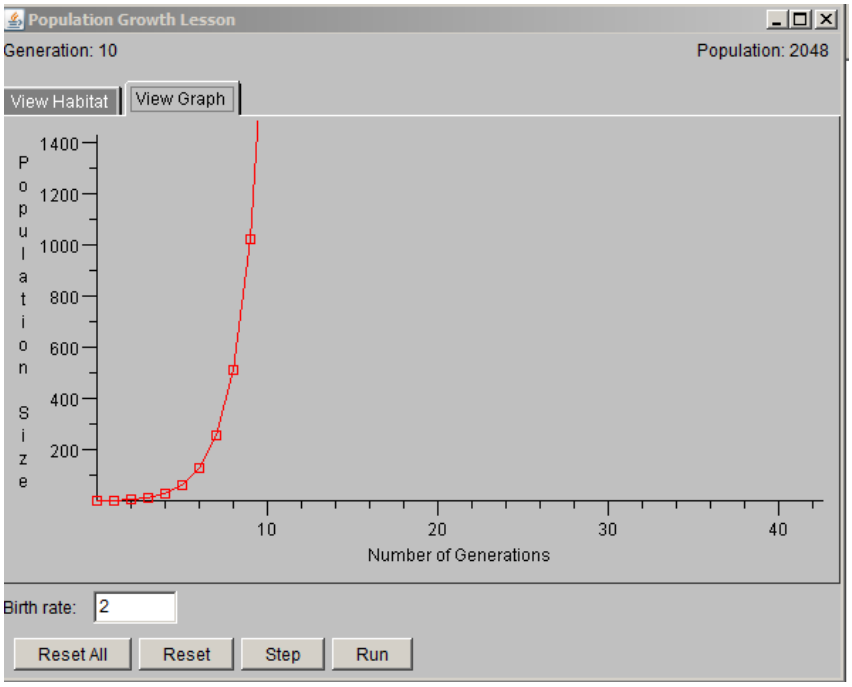
A = 304 bacteria

12	$A = 2(1.52)^{12}$	$A = 304$

Under ideal conditions:

1. the **biotic potential** of a population is the maximum rate at which it can increase
2. **exponential growth** occurs - the population increases by the same percent from one time period to the next.

http://www.otherwise.com/population/exponent.html



- In nature, there are always limits to growth. A population will reach a size limit imposed by a shortage of one or more of the **limiting factors** of light, water, space and nutrients.
- **Carrying capacity** represents the highest population that can be maintained for an indefinite period of time by a particular environment.
- When a population grows exponentially at first, and then levels off to a stable number near the carrying capacity, it is called **logistic growth**. Logistic growth is much more common in nature than long-term exponential growth.
- **Natural Capital** - refers to all the natural resources on which people depend upon and includes resources we use to produce manufactured goods.