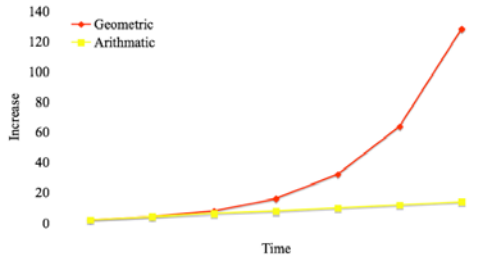# Human Demography

Population structure

- Size
  - Births
  - Deaths
  - Rate
- Age structure
  - Cohorts
  - Age classes

"Population...increases in a geometric ratio. Subsistence increases...in an arithmetic ratio"
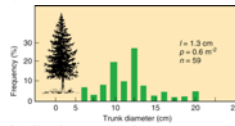
Population size, N

$$N = b - d$$

Births:
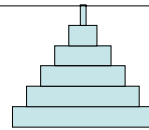Limited only by constraints
"Over-reproduction"

Deaths:
Major control of population size
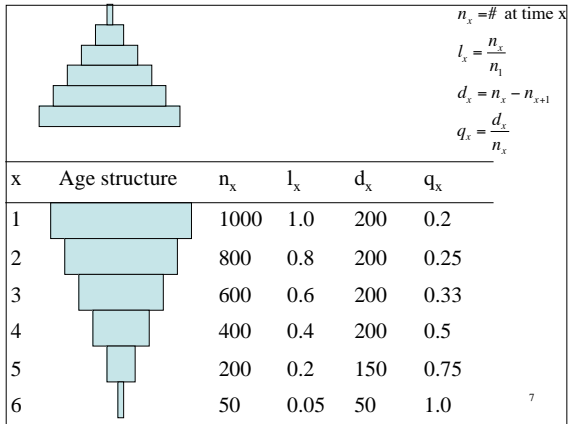Density dependent
Density independent

Age structure

Life history tables

- Age class (x)
- Number of individuals in an age class (n_x)
- Probability of surviving to x (l_x)
- Number dying in an interval (d_x)
- Probability of dying (q_x)

$$n_x = \#\ \text{at time x}$$
$$l_x = \frac{n_x}{n_1}$$
$$d_x = n_x - n_{x+1}$$
$$q_x = \frac{d_x}{n_x}$$

x	Age structure	n_x	l_x	d_x	q_x
1		1000	1.0	200	0.2
2		800	0.8	200	0.25
3		600	0.6	200	0.33
4		400	0.4	200	0.5
5		200	0.2	150	0.75
6		50	0.05	50	1.0

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Other life history components

- Number of individuals alive at interval midpoint (L_x)
- Total number of years still to be lived (T_x)
- Life expectancy at age x (e_x)

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$$L_x = \frac{(n_x + n_{x+1})}{2}$$
$$T_x = \sum L_x$$
$$e_x = \frac{T_x}{L_x}$$

x	n_x	l_x	d_x	q_x	L_x	T_x	e_x
1	1000	1.0	200	0.2	900	2550	2.83
2	800	0.8	200	0.25	700	1650	2.36
3	600	0.6	200	0.33	500	950	1.9
4	400	0.4	200	0.5	300	450	1.5
5	200	0.2	150	0.75	125	150	1.2
6	50	0.05	50	1.0	25	25	1

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Survivorship curves

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Mortality curves

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