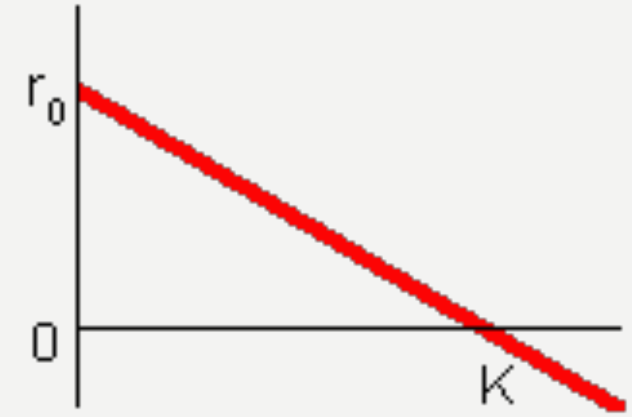
LOGISTIC MODEL

- by Pierre Verhulst (1838)- The rate of population increase may be limited, i.e., it may depend on population density:
- Logistic equation $r = r_0(1 - \frac{N}{K})$
- At low densities (N < < K), the population growth rate is maximum = $\mathbf{r_o}$.

$$\frac{dN}{dt} = rN = r_0N(1 - \frac{N}{K})$$



- Population growth rate declines with population numbers, N,

  and reaches 0 when N = K.

  Parameter K is the upper limit of population growth (carrying capacity).

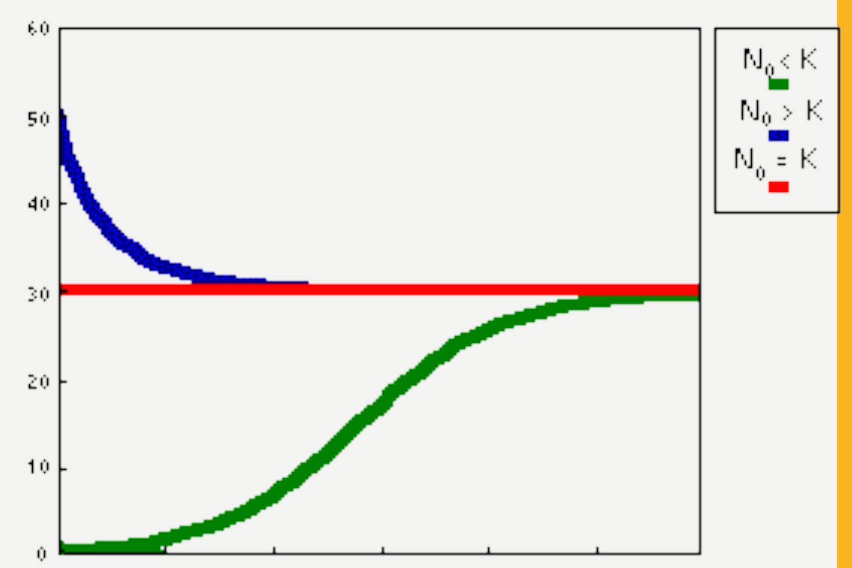
- **Carrying capacity K -** The maximum number of individuals that can live in a population stably; numbers larger than this will suffer a negative population growth until eventually reaching the carrying capacity, whereas populations smaller than the carrying capacity will grow until they reach it.

- **Three possible model outcomes**

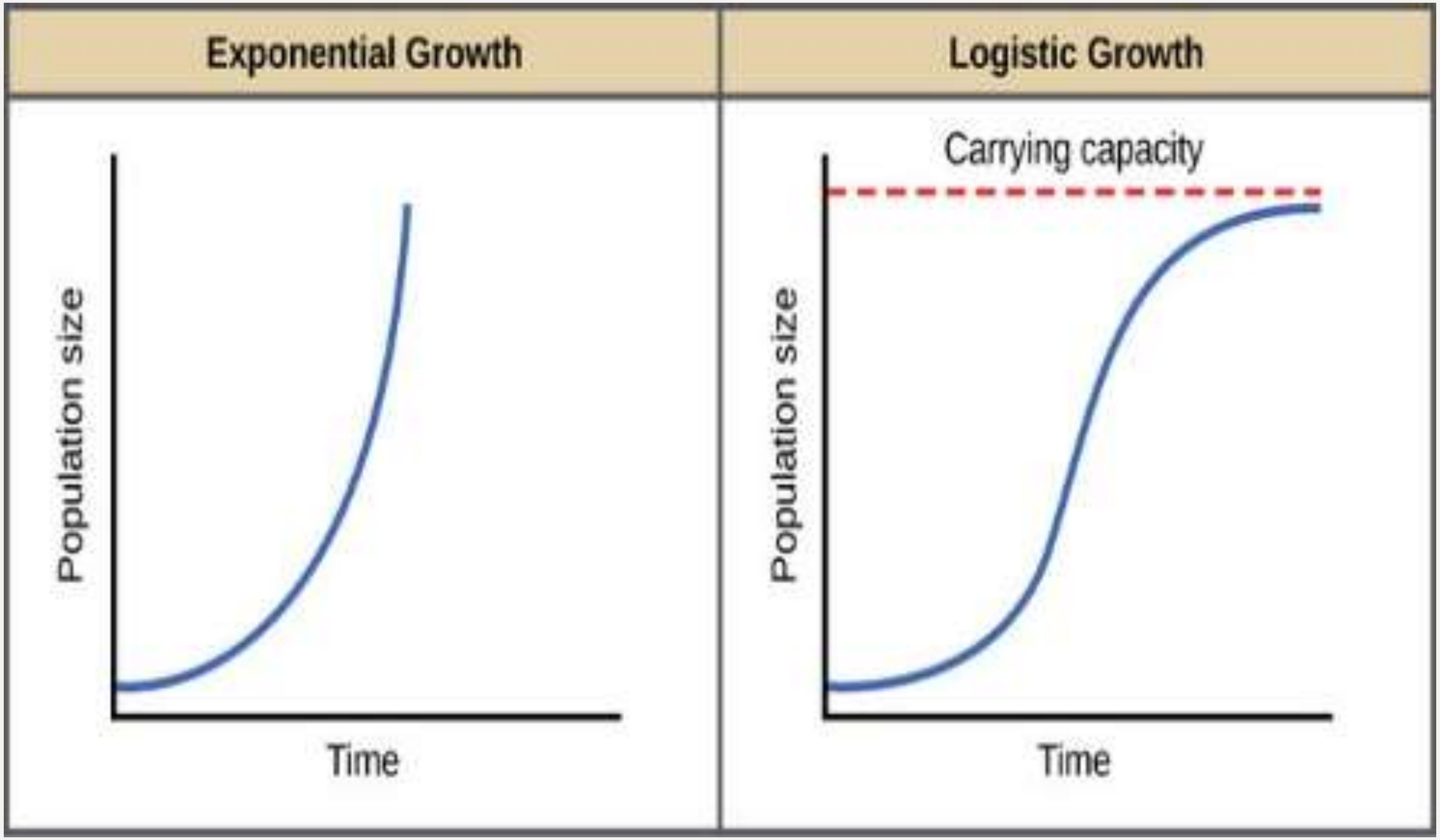
  Population increases and reaches a plateau (No < K). This is the logistic curve.

  Population decreases and reaches a plateau (No > K)

  Population does not change (No= K or No = 0)



- **Assumptions of the logistic model:**
  - Each individual has identical ecological properties
  - Instantaneous response to environmental change
  - Limited space and constant food supply
  - Age distribution is stable



Exponential Growth
Logistic Growth
Carrying capacity
Population size
Time
Population size
Time