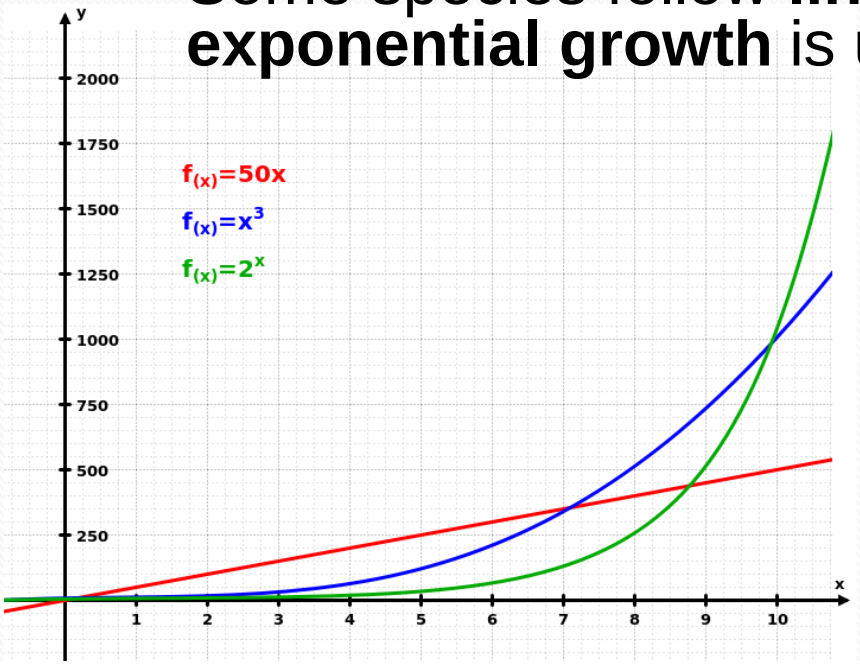
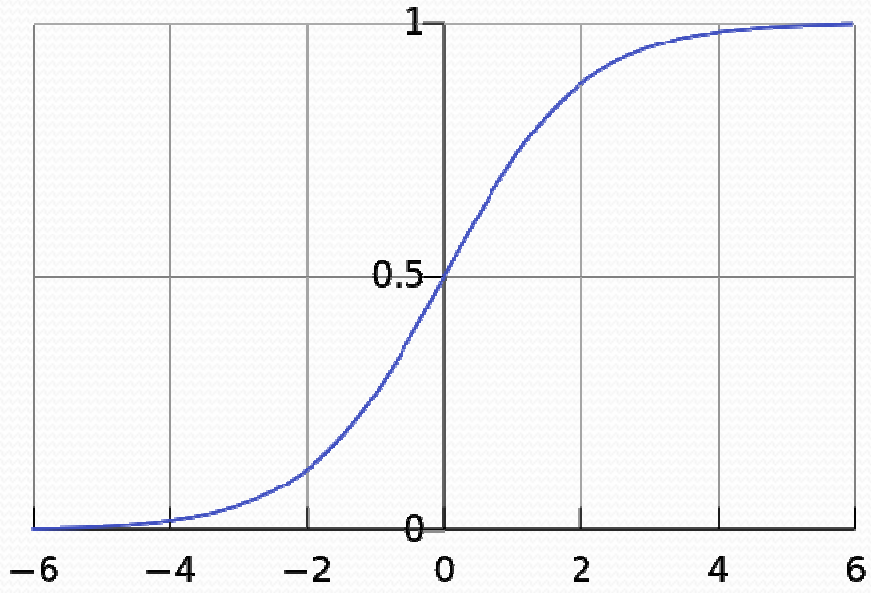
Refining CBA

Population growth

Population growth

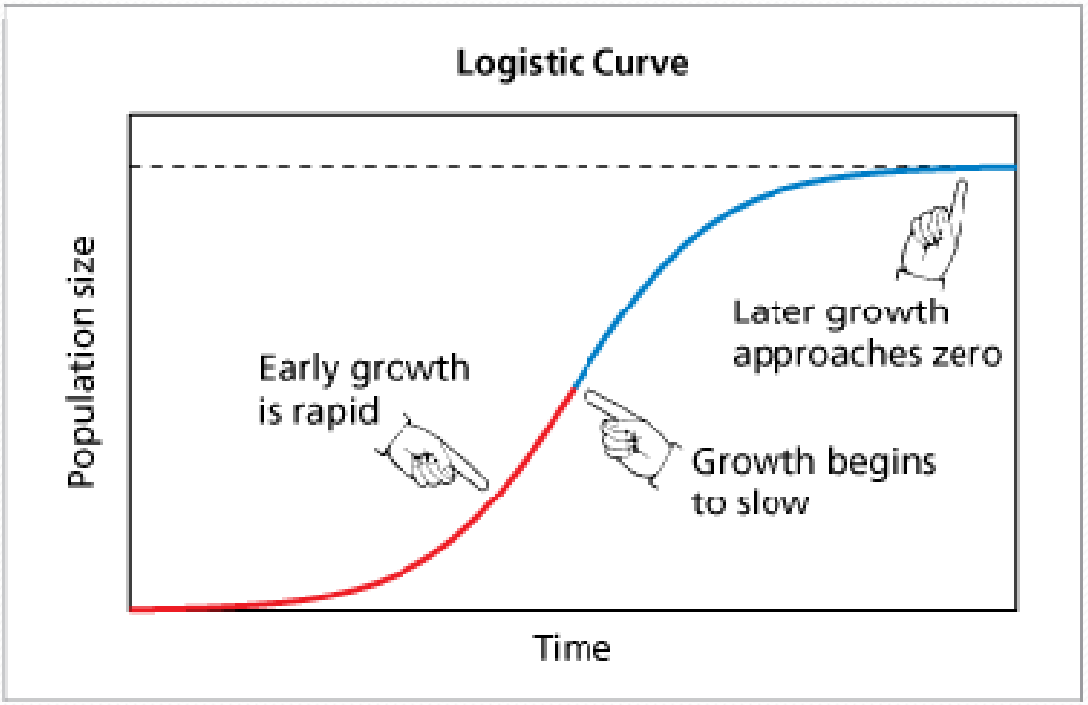
- The damages caused by invasive species are proportional to their population
  - The population of most living organisms follows a **logistic growth curve**
  - Some species follow **linear growth** curves, but **exponential growth** is uncommon





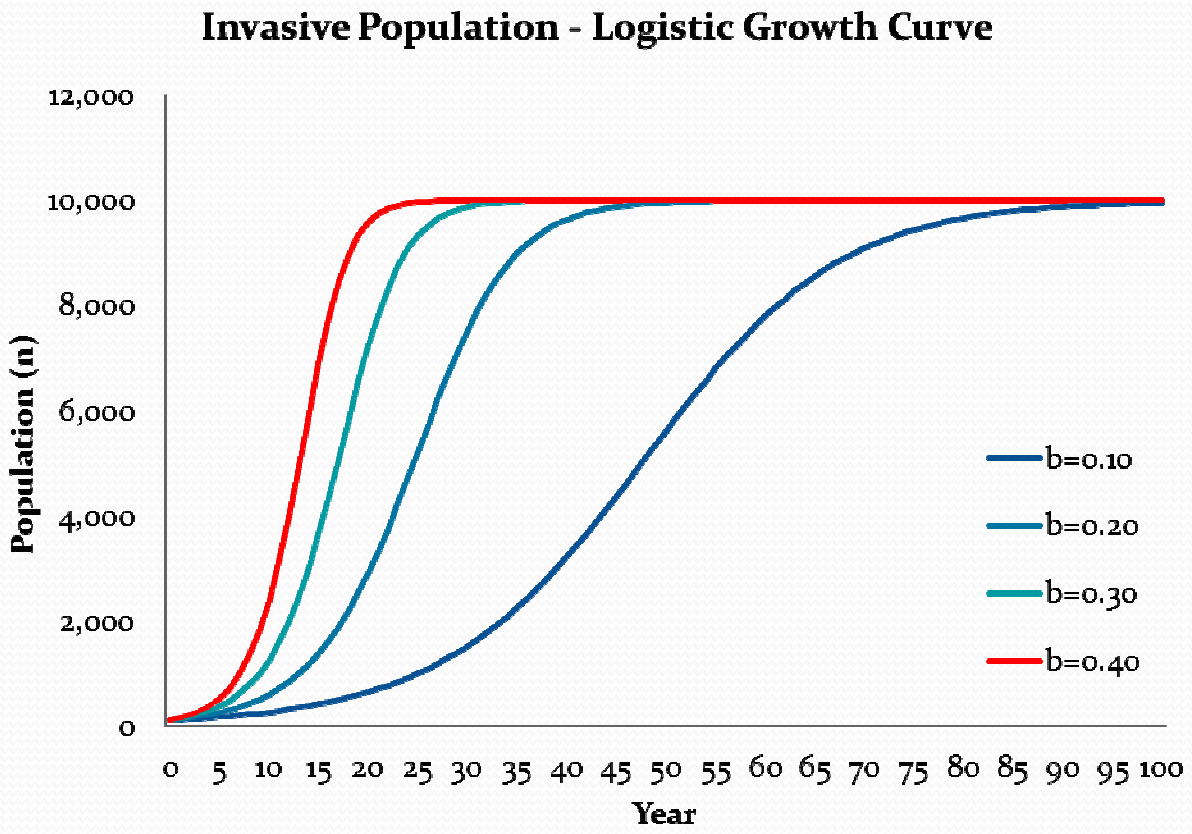
Population growth

- Logistic growth: $\frac{dN}{dt} = bN_t\left(1 - \frac{N_t}{N_{\max}}\right)$
- where b = the proportional growth of the population, N, in one year
- N_t = population at time t
- N_{max} = **carrying capacity** of the population



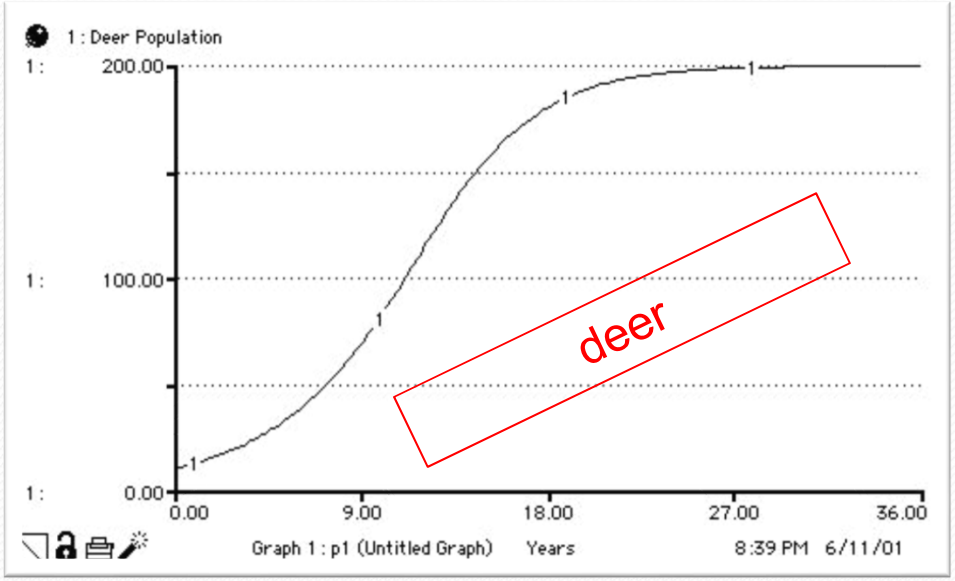
Population growth

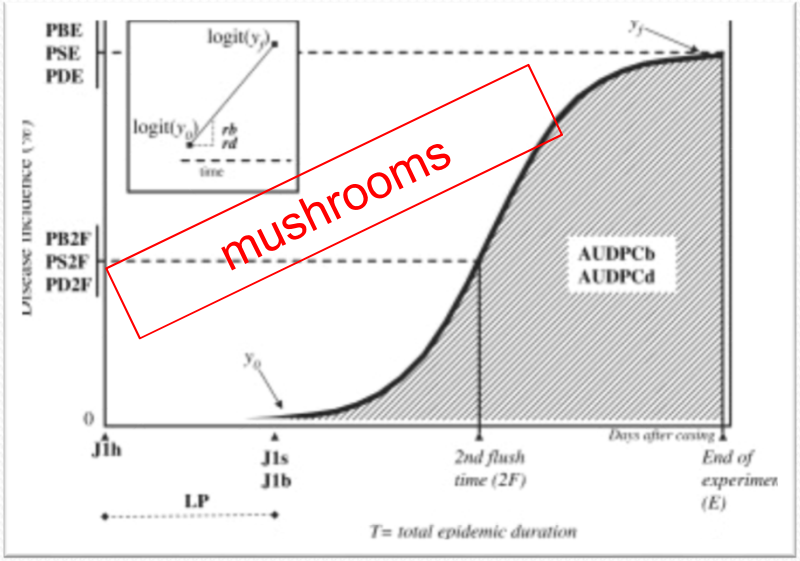
- With the same initial population, as b increases, the population reaches carrying capacity more quickly

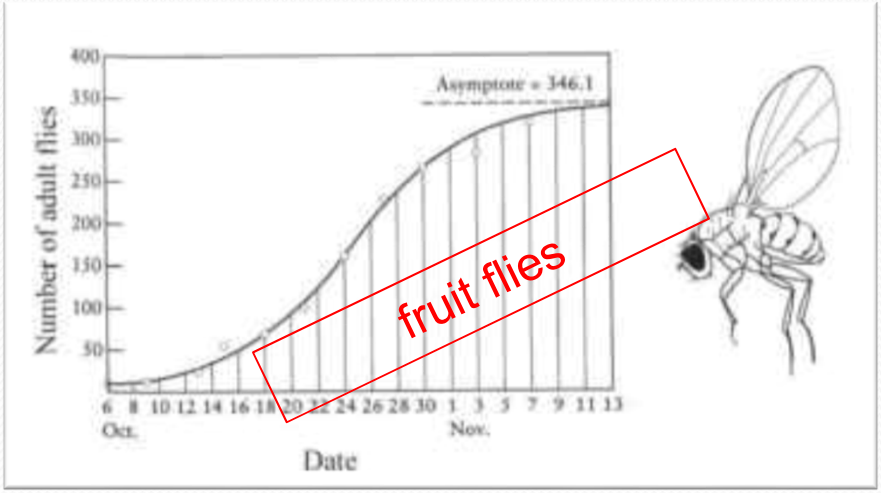


Population growth

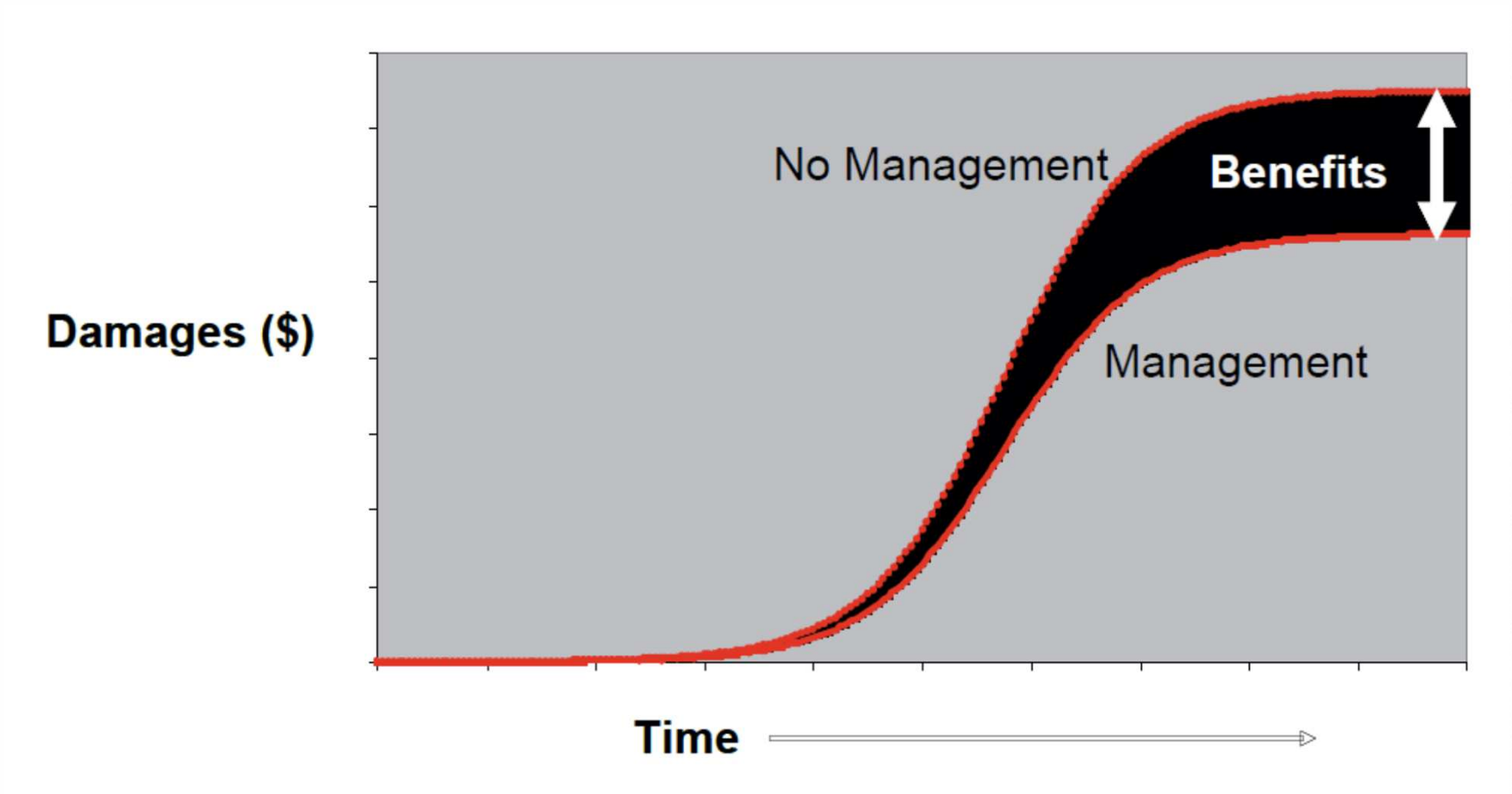
- Most living things follow this pattern



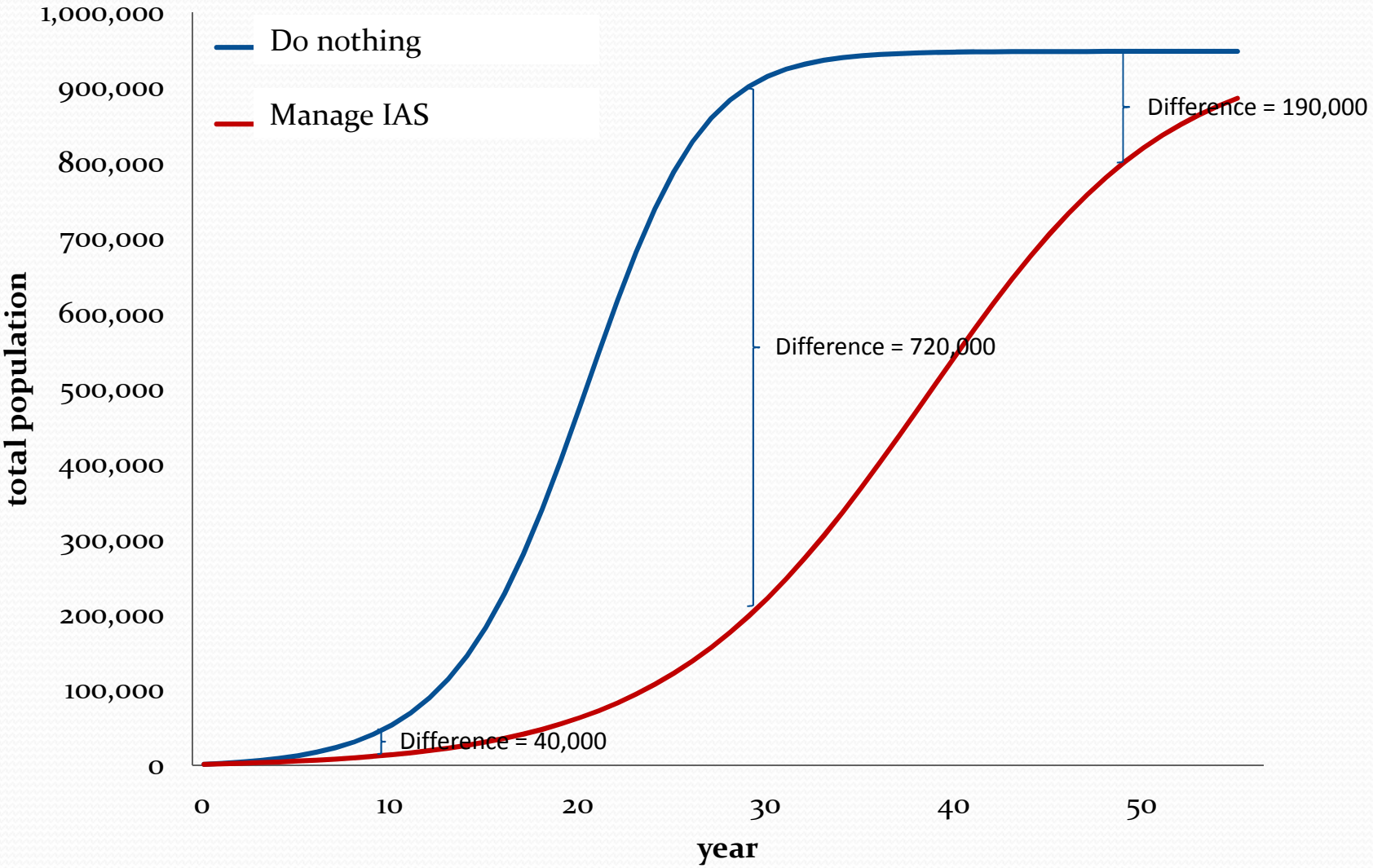




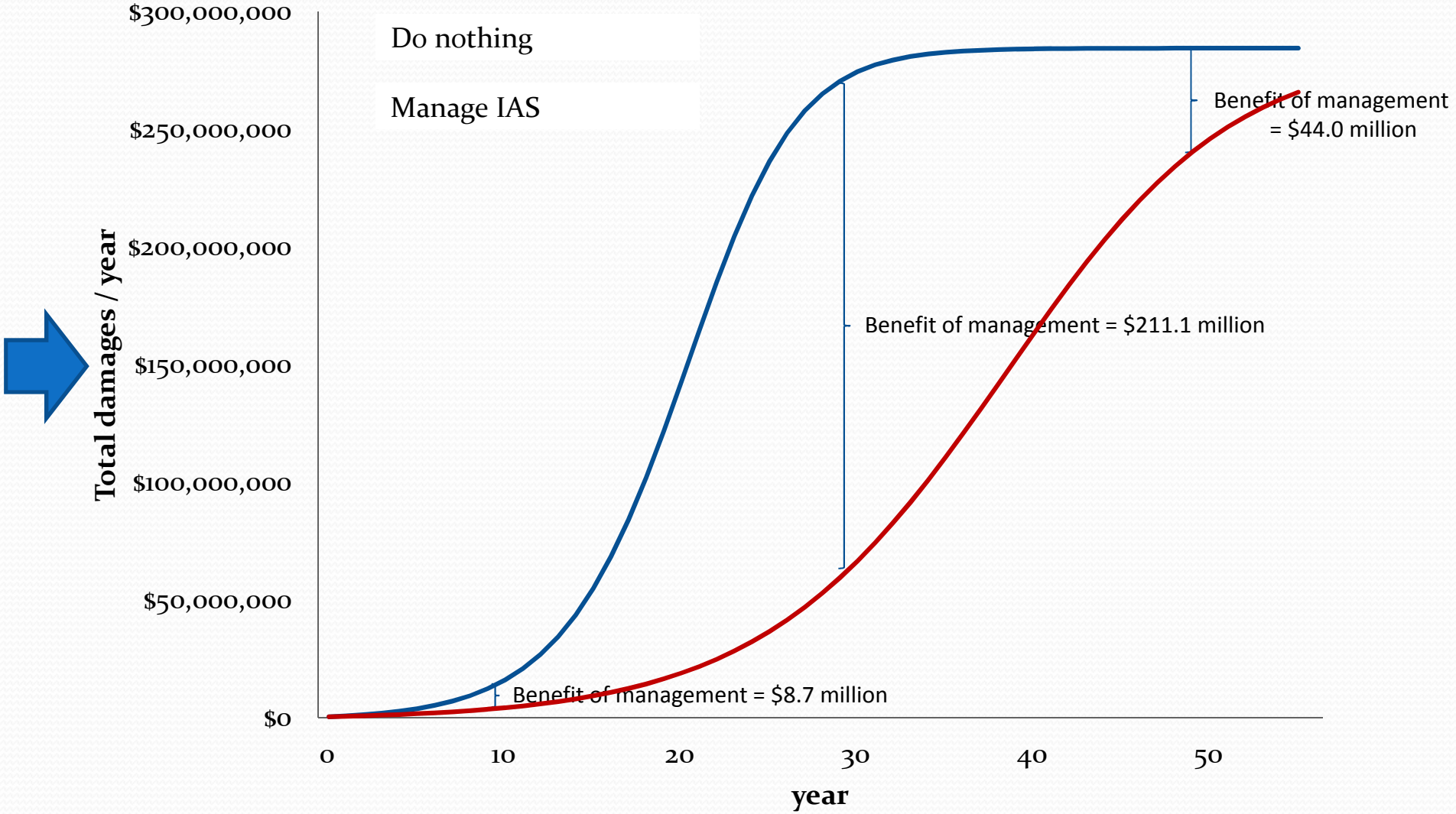
Estimating avoided damages from changes in the population



Total Population



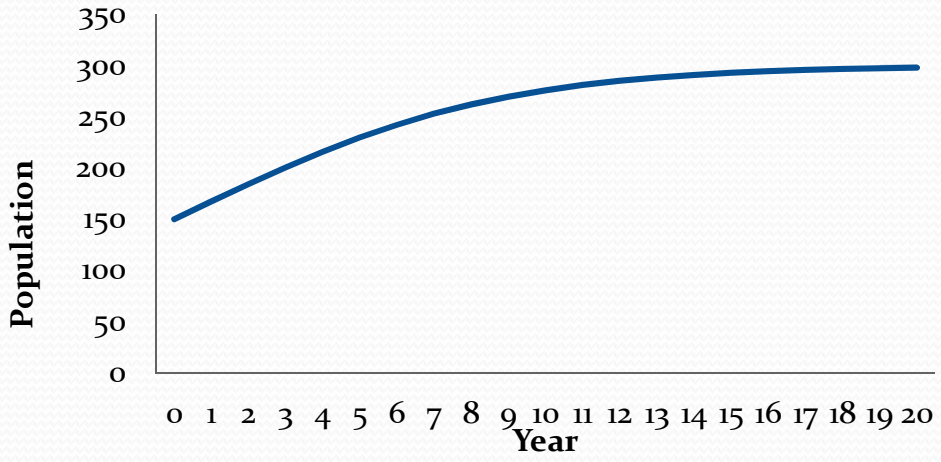
Total Monetary Damages



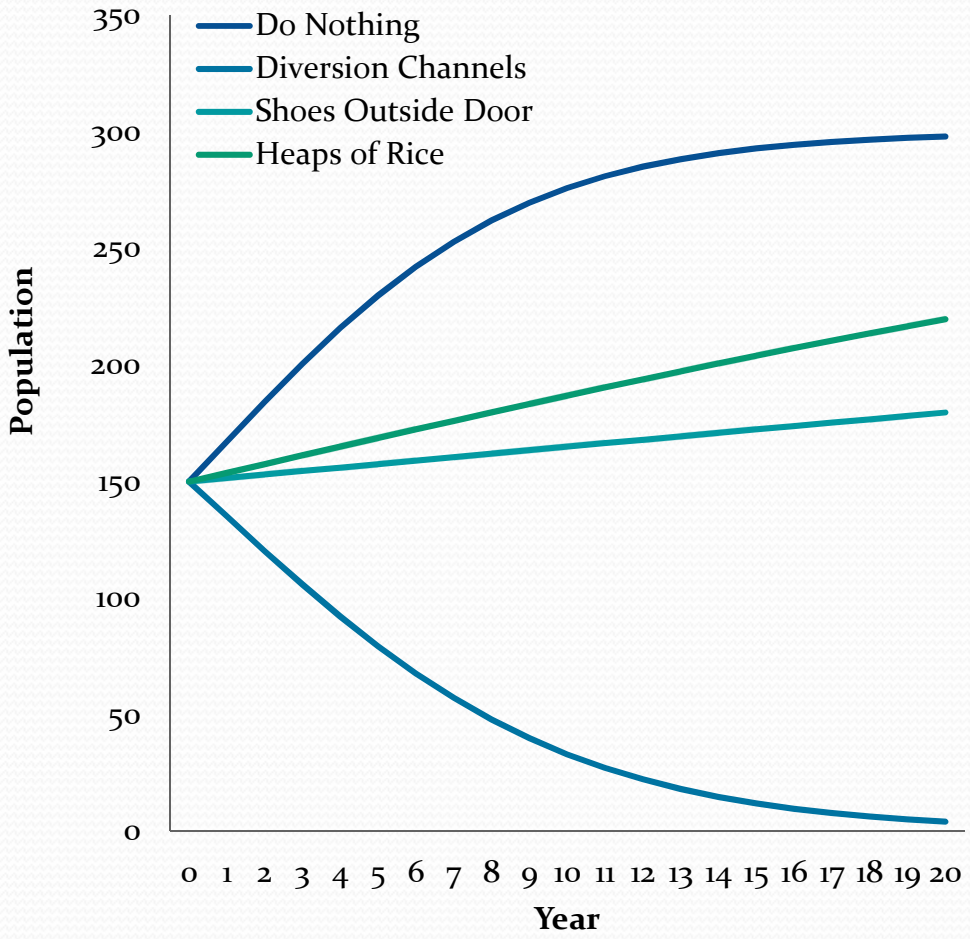
Population growth of jumbees

$$\frac{dN}{dt} = bN_t\left(1 - \frac{N_t}{N_{\max}}\right)$$

- Current population (N_t) = 150
- Carrying capacity (N_{max}) = 300
- Proportional growth rate (b) = 0.23



Jumbee Population by Management Option



Option	N_o	b	N_Max
Do Nothing	150	0.23	300
Diversion Channels	150	-0.2	300
Shoes Outside	150	0.02	300
Heaps of Rice	150	0.05	300