What is Population Growth?

Worksheet

Population growth is the change in the number of individuals in a population over time; under unlimited resources it follows exponential growth, N = N0e^(rt), where r is the intrinsic growth rate.

$$\frac{dN}{dt} = rN$$

Questions

1. A population grows exponentially with N0 = 100 and r = 0.1/year. What is N after 10 years (e^1 2.72)?

A) 272
B) 110
C) 1000
D) 72

2. What best describes carrying capacity?

A) The initial population size
B) The maximum sustainable population an environment can support
C) The rate of birth minus death
D) The number of predators in an area

3. Which factor DECREASES population size?

A) Immigration
B) Birth
C) Emigration
D) Growth rate

4. Logistic growth differs from exponential growth because it...

A) Never slows down
B) Levels off near the carrying capacity
C) Ignores resource limits
D) Only applies to bacteria

5. A bacterial population starts at 200 cells and grows at r = 0.2/year (continuous rate). Find the population after 5 years.

6. A deer population of 50 grows at r = 0.1/year. Estimate the population after 10 years.

7. A town of 1000 people has a birth rate of 0.03/year and death rate of 0.01/year (no migration). Find the population after 20 years.

8. Define: What is population dynamics?

9. Define: What is exponential growth?

10. Define: What is carrying capacity (K)?

Answer Key

1. A) 272 - N=100e^(0.110)=100e^1272.

2. B) The maximum sustainable population an environment can support - Carrying capacity (K) is the population size an environment can sustain long-term.

3. C) Emigration - Emigration (individuals leaving) and deaths reduce population size.

4. B) Levels off near the carrying capacity - Logistic growth accounts for limited resources, flattening near K.

5. N0 = 200, r = 0.2/year, t = 5 years N = N0 e^(rt) = 200 e^(0.25) = 200 e^1 e^1 2.718 N 200 2.718 544 individuals

6. N0 = 50, r = 0.1/year, t = 10 years N = 50 e^(0.110) = 50 e^1 N 50 2.718 136 individuals

7. r = birth rate death rate = 0.03 0.01 = 0.02/year N0 = 1000, t = 20 years N = 1000 e^(0.0220) = 1000 e^0.4 e^0.4 1.492 N 1492 people

8. The study of how population size changes over time due to births, deaths, immigration, and emigration.

9. Growth with unlimited resources: N = N0e^(rt); the population increases faster and faster over time.

10. The maximum population size an environment can sustainably support given its resources.