www.scienceinschool.org

Let's make a chemical clock

Info sheet 2: Foxes-rabbits-grass pattern

Dynamics of chemical oscillators can be compared to some typical population dynamics of living beings. Below is a very simplified example (figure 1).

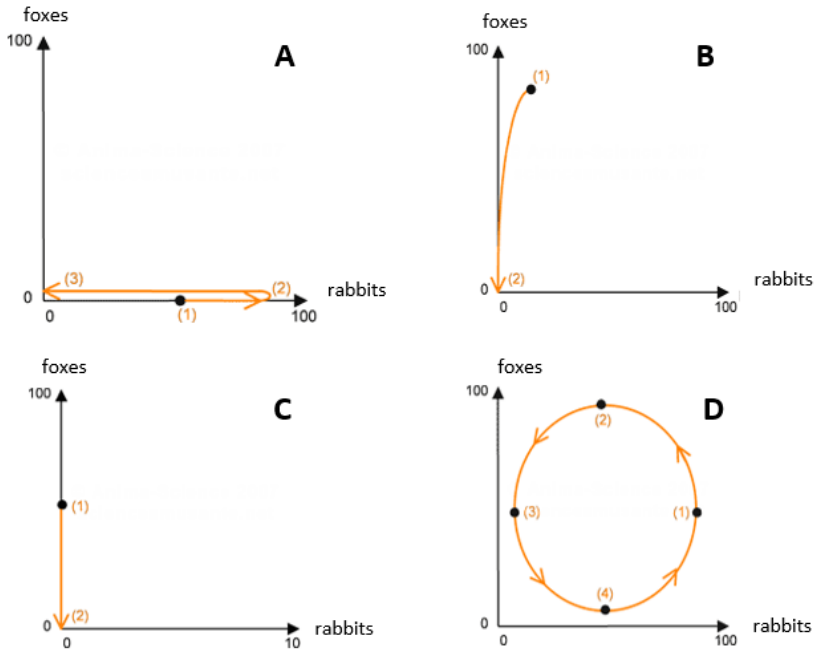

Figure 1: Variation in the number of rabbits and foxes in different initial situations with infinite amount of vegetation. Image courtesy of the author

Explanation

A

Only rabbits and no foxes (1): the rabbit population will grow until it has consumed all the grass (2). After this, the population will drop to zero (3).

B

Foxes prevail over rabbits (1): the rabbit population will decrease rapidly until it reaches zero. The same will happen to the fox population, which will die of hunger (2).

C

Only foxes and no rabbits (1): the fox population will decrease to zero (2) since they are not herbivores.

D

Both populations are large (1): foxes feed on rabbits and reproduce, increasing their population while the rabbit population decreases (2). At a certain point, the fox population will also decrease, as food will become scarce (3). Consequently, the number of rabbits will increase (4). At this point, foxes will have more prey available, and their population will increase again (1).

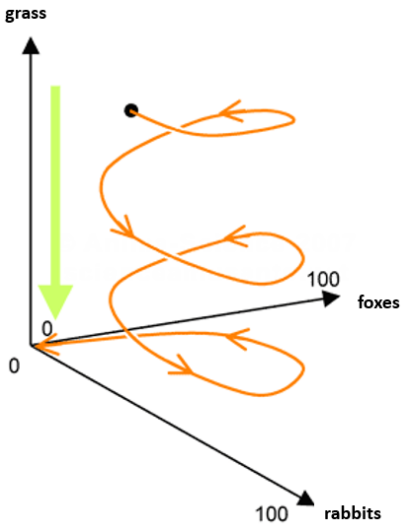

Figure 2: Variation in the number of rabbits and foxes with a finite amount of vegetation. Image courtesy of the author

The cycle of chart **D** will not repeat itself exactly over time due to the random fluctuations of some of the system's variables, nor can it repeat indefinitely due to the finite amount of vegetation. Once all the grass is gone, all the rabbits will die, followed by the foxes. The system will inevitably tend toward this state of equilibrium (figure 2).

If foxes, rabbits, and grass represent chemical species involved in oscillating reactions, then the oscillations will similarly dampen out until they disappear.