Lotka - Volterra practice.

In an ecosystem, we currently have 125 bison and 15 elk. These species are known to compete for some, but not all, of their resources. We are able to determine that the carrying capacity of bison (K_1) is 200 and that the α is 4. The carrying capacity for elk (K_2) is 100 & the β is 1. Over time, will both species be able to co-exist? If not, which one will be driven to extinction in this area/ecosystem?

Soln

we know the eqn.

$$\frac{dN_1}{dt} = \gamma N_1 \left(\frac{K_1 - N_1 - \alpha N_2}{K_1} \right) \quad \&$$

$$\frac{dN_2}{dt} = \gamma N_2 \left(\frac{K_2 - N_2 - \beta N_1}{K_2} \right).$$

At the equilibrium or at the zero growth rate $\frac{dN_1}{dt}$ &

$$\frac{dN_2}{dt} = 0.$$

$\therefore K_1 - N_1 - \alpha N_2 = 0.$ & $K_2 - N_2 - \beta N_1 = 0.$

when $N_1 = 0$, $N_2 = \frac{K_1}{\alpha}$ when $N_1 = 0$, $N_2 = K_2$

$N_2 = 0$, $N_1 = K_1$ $N_2 = 0$, $N_1 = \frac{K_2}{\beta}$.

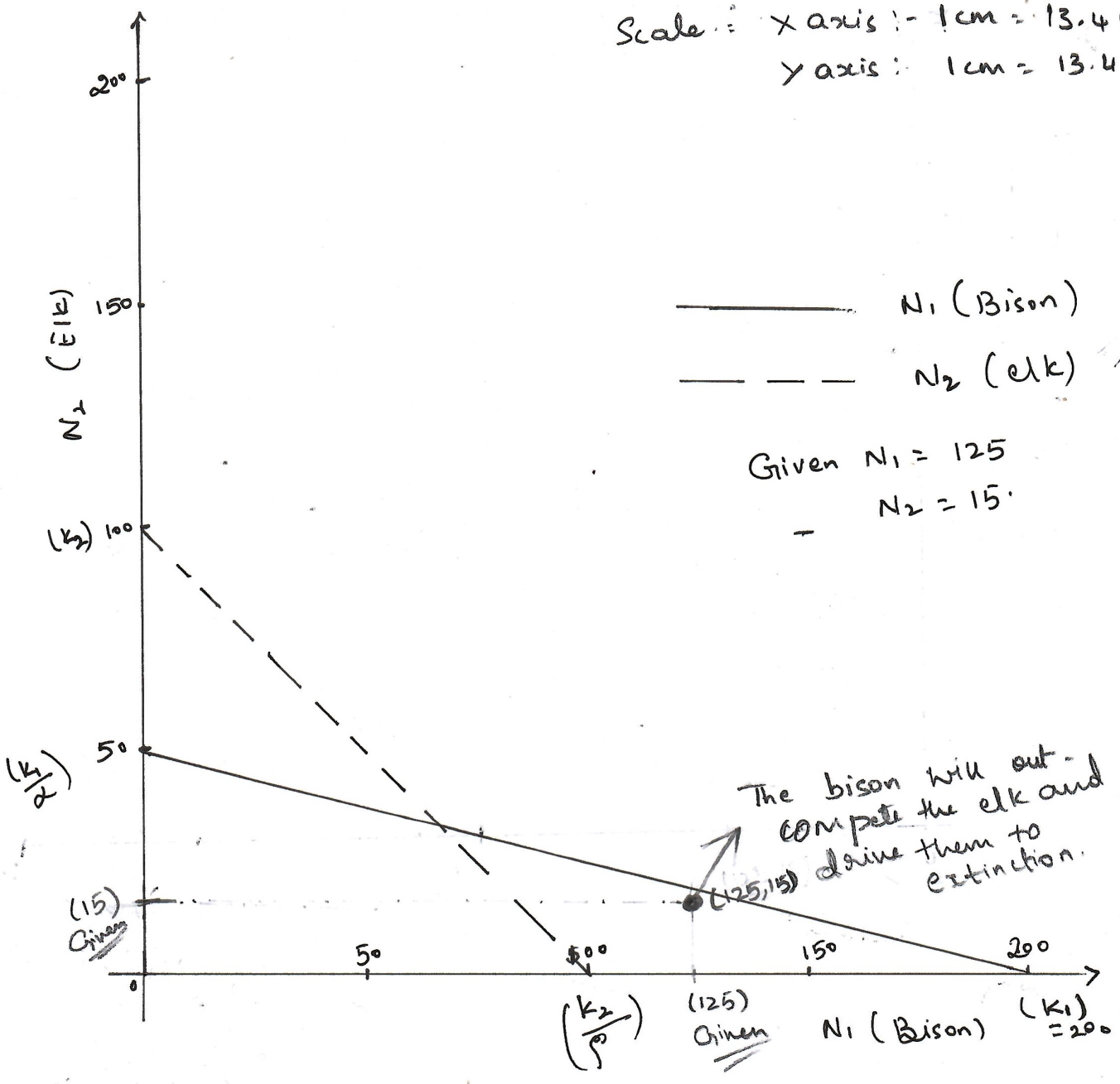
we know from the problem statement

$K_1 = 200$, & $K_2 = 100$; $\alpha = 4$ & $\beta = 1$

$\therefore \frac{K_1}{\alpha} = \frac{200}{4} = 50$ & $\frac{K_2}{\beta} = \frac{100}{1} = 100$

Scale : x axis :- 1 cm = 13.4 No

y axis : 1 cm = 13.4 No



Given $N_1 = 125$

$N_2 = 15$.