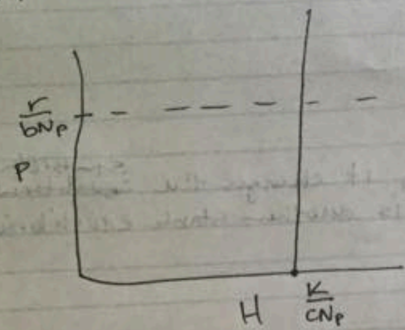
1. a) $\frac{dH}{dt} = rH - bHPN_p$

$\frac{dP}{dt} = N_p cHP - kP$

b)

c)



This predator interaction makes sense because often times in nature, predators will help each other. Insect outbreaks do work with this model, as well as a pack of wolves for example. ~~The exact form doesn't matter for drawing conclusions because the added term's effect~~ The fact that the exact form of the predation rate is not critical shows how adding N_p will have a similar effect regardless of the predation rate.

3. X = pesticide effect $\quad X_p > X_H$

$\frac{dH}{dt} = rH\left[1 - \frac{H}{k}\right] - bHPX_H$

$\frac{dP}{dt} = cHP - kPX_p$

4. a) $\frac{dH}{dt} = rH - bP(1 - \frac{R}{H})$ $\quad$ R = # of refuge prey

$\frac{dP}{dt} = cHP(1 - \frac{R}{H}) - kP$

b) $\frac{dH}{dt} = rH - bP(H - R)$

$\frac{dP}{dt} = cP(H-R) - kP$

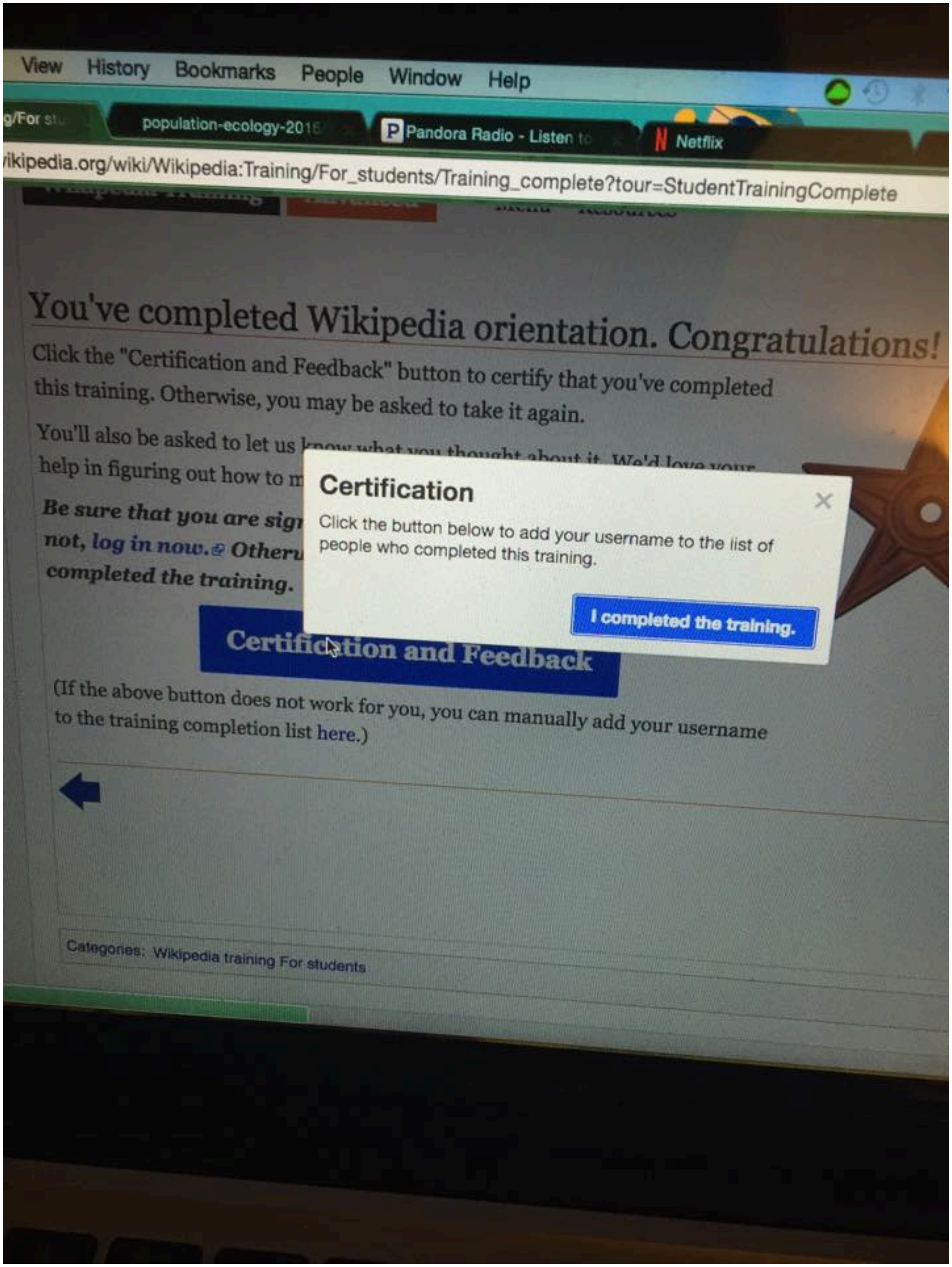
c) $rH - bP - \frac{bPR}{H} = 0 = \frac{dH}{dt}$

$rH^2 - bPH = bPR$

$\frac{rH^2}{bP} - H = R$

$H = \frac{rH^2}{bP} - R$

By adding the refuges, it changes the ~~equilibrium~~ stability so that there is another stable equilibrium point.



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