

Qualitative Differential Equations, *Kazanci*

Homework Assignment (*due 10/29/09*)

Consider the following predator prey system:

$$\begin{aligned}u' &= ru(1-u) - \frac{puv}{k+u} \\v' &= \frac{puv}{k+u} - dv\end{aligned}$$

1. Explain the advantage of this predation term ($\frac{puv}{k+u}$) over the more common one (cuv). Explain the physical meaning of each parameter: r, d, p, k .
2. Assume that $r = 2, p = 0.5, d = 0.2, k = 0.5$. Find all fixed points and analyze their stability using linearization. What happens to u and v as $t \rightarrow \infty$?
3. Write an XPP code for this system above. Plot nullclines, scaled direction field, and a couple of trajectories (on the same figure). Print this figure and your code, and include them in your HW solutions.
4. We are interested in the effects of an increase in the the predation rate (p) on prey population (u). To accomplish this, use XPPAUT to plot the bifurcation diagram for $0.5 < p < 3$. I suggest using the following numerical parameters: $NPr=500, Nmax=2000, Par Max=3, Dsmax=0.05$. Print and include this diagram in your HW solutions. Describe the effects of increasing predation rate.