FW364
Ecological Problem Solving

List of equations needed to solve problems on the exams. These equations do not include basic algebraic relations, such as rules for working with logs, which you must be familiar with as well.

$T = S/F$	This is the fundamental equation for mass balance problems. Rearrange it as needed to suit the demands of the question.
$S_{t+1} = S_t + F_i - F_o$	This is the basic equation that describes changes in stock size (S) as a function of inputs (F_i) and outputs (F_o). This can be applied to mass balance problems and population problems. Assuming steady-state, convince yourself that this equation means that inputs = outputs.
$N_t = N_0\lambda^t$ $N_t = N_0(1 + b' - d')^t$ $N_t = N_0(s + f)^t$	These are the basic equations for projecting population size (N_t) given a constant, **finite** rate of increase. Note that λ is the **net** rate of population growth. You should be able to re-arrange these equations as needed to suit the demands of the question.
$N_t = N_0e^{rt}$ $N_t = N_0e^{(b - d)t}$	These are the basic equations for projecting population size given a constant, **instantaneous** rate of increase. Note that r is the **net** rate of population growth. You should be able to re-arrange these equations as needed to suit the demands of the question.
$r = r_{\max}\left(1 - \frac{N}{K}\right)$	This is the logistic equation for density-dependent population growth (instantaneous form). This equation applies to scramble competition within a population, and was used in predator-prey and two-species competition models.
$P_p = 1 - (p_e)^x$	This equation calculates the probability of metapopulation persistence (P_p) from the probability of local population extinction (p_e), for the case where local extinctions are completely independent events. The number of local populations in the metapopulation is x.
$f = \frac{f_{\max}R}{R + h}$	This equation describes a Type II functional response: feeding rate (*f*) as a saturating function of food (resource, *R*) abundance.
$b = \frac{b_{\max}R}{R + h}$	This is the MONOD equation: birth rate as a saturating function of food (resource) abundance.