Population Dynamic Formulas & their Assumptions

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| Name | Formula | Variables | Assumptions  |
| **Continuous Exponential** **Growth Model**(for populations continually adding new individuals) | Nt = N0 ert | r < 0 Pop. Decreasingr > 0 Pop. Increasingr = 0 constant N0 = Initial populationNt = Population at time, tt = unit of timer = per capita rate of growth  | All individuals are identicalNo age/ genetic differenceNo EvolutionBirth rate and death rate are constantClosed population (no immigration or emigration)Habitat is perfectly uniform  |
| **Discrete Exponential Growth Model**(for populations that have specific breeding seasons and cannot continually reproduce) | Nt = N0 λt | Image result for lambda**< 1** Pop. DecreasingImage result for lambda**> 1** Pop. increasingImage result for lambda**= 1** Pop.constantN0 = Initial populationNt = Population at time, tt = unit of timeλ = per capita rate of growth  | All individuals are identicalNo age/ genetic differenceNo EvolutionBirth rate and death rate are constantClosed population (no immigration or emigration)Habitat is perfectly uniform  |
| **Discete Doubling Time**  | ln (2) / ln (λ ) = t2 | t2 = unit of time it takes to double populationλ = per capita rate of growth |  (Note: this can be derived from the above equations by having N0 = 1 and Nt= 2, then solve for t)  |
| **Continuous Doubling Time**  | ln (2) / r = t2 | t2= unit of time to double populationr = per capita rate of growth | (Note: this can be derived from the above equations by having N0 = 1 and Nt= 2, then solve for t)  |

Using population dynamic equations, like the ones above allow for to estimate population numbers over time, given the assumptions above. This is useful for wildlife managers and conservationists. The exponential equations assume that growth is unlimited, make sure to discuss the reality of this with your students. What things limit populations? (food, habitat, competition, etc…)