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. Decreasing  r > 0 Pop. Increasing  r = 0 constant  N0 = Initial population  Nt = Population at time, t  t = unit of time  r = per capita rate of growth | All individuals are identical  No age/ genetic difference  No Evolution  Birth rate and death rate are constant  Closed 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. Decreasing  Image result for lambda**> 1** Pop. increasing  Image result for lambda**= 1** Pop.constant  N0 = Initial population  Nt = Population at time, t  t = unit of time  λ = per capita rate of growth | All individuals are identical  No age/ genetic difference  No Evolution  Birth rate and death rate are constant  Closed 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 population  λ = 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 population  r = 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…)