Stabilizing elephant population using contraceptive darts

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Important Parts in this Model

- Used Object-Oriented Paradigm to solve the population growth problem
- Every model will deal with birth of the elephants
  - Every female elephant between ages 10-60, not pregnant and not in the courtship period will be able to reproduce
  - Parameters: Courtship time = 3.5 years
  - Parameters: Pregnancy period = 22 months = 1.83 years
- Death of the Elephants
  - Natural death: age > 70
  - Adults Death: Survival Rate: 96%
  - Infants Death: Survival Rate: 75%
- Contraceptive Darts

Darting Probability

P(darting a female cow) = $\frac{1}{1 + exp(\frac{x-\mu}{\sigma})}$

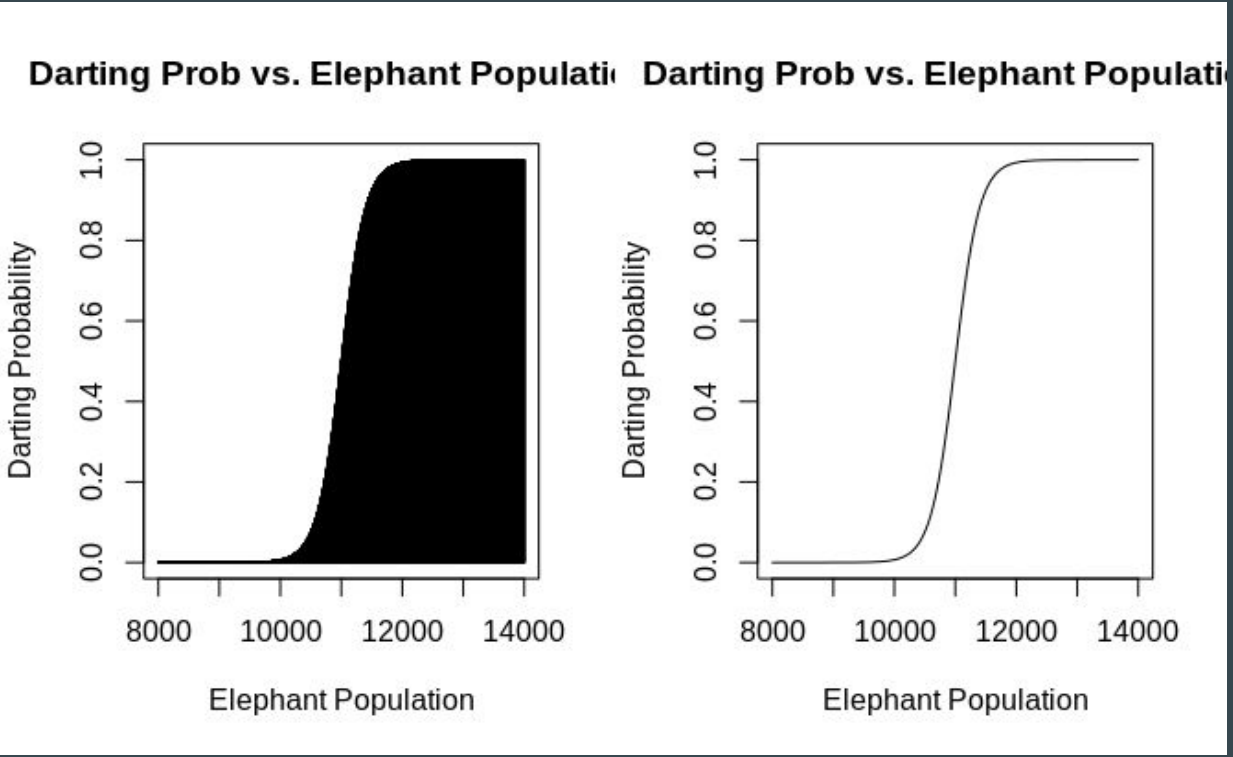
X = Total Population of the Elephants where Pregnant cows are counted as 2 elephants

μ = 11000 = desired population that is a hyperparameter

σ = 200 = Scale of the population

The scale is the range of oscillation of the population we'll have while it converges to 11000. For our model, the range is between 9000 to 13000.

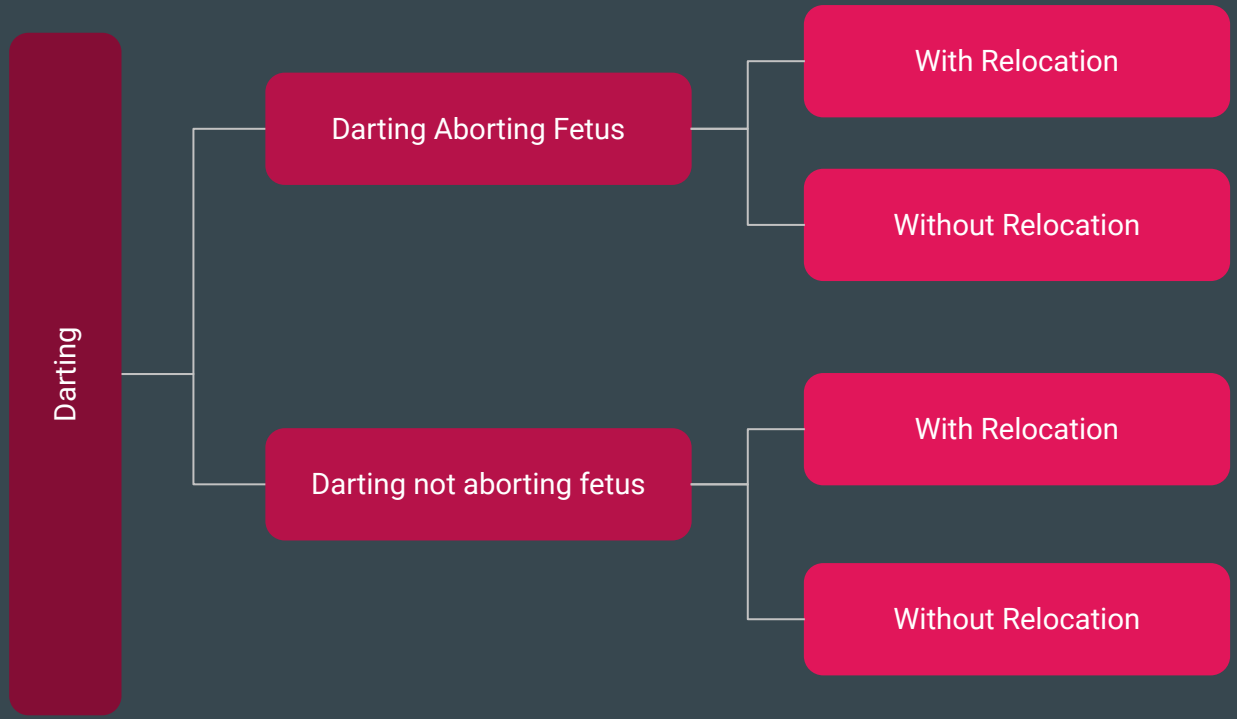
Darting Probability



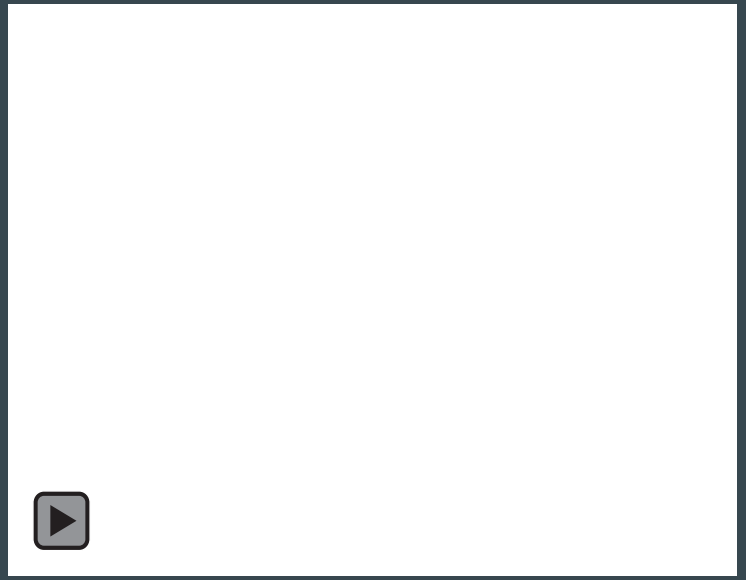
Assumptions made

1. We assumed that the relocation data that was given to us was a good representation of the population of elephants.
2. Relocation that we're performing happens for one park
3. Darting doesn't affect the pregnant cow's fetus vs. darting aborts the fetus.
4. Relocation could happen every year. This will yield us four different models

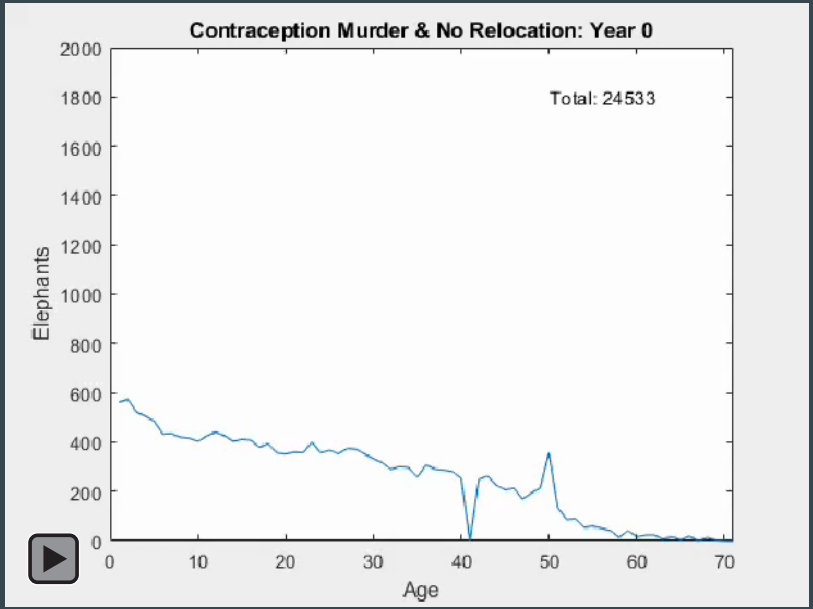
Population Control using Contraception and Relocation



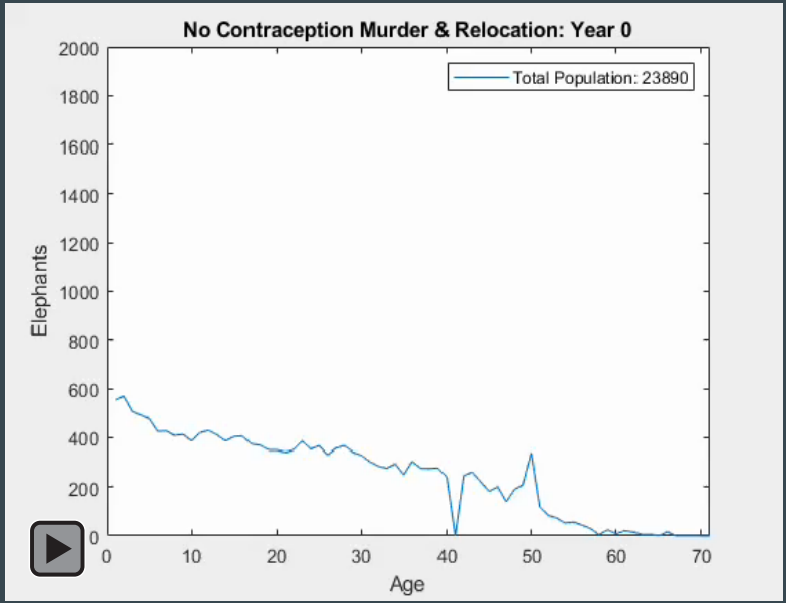
Darting w Abortion and with Relocation



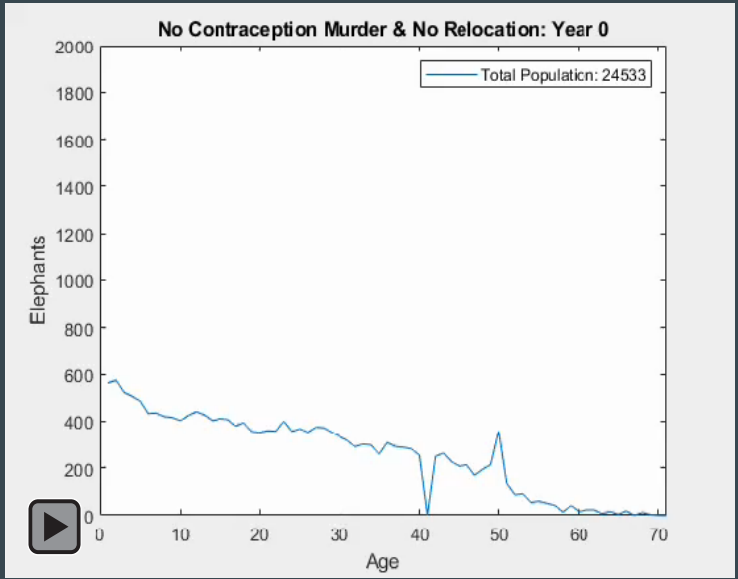
Darting w Aborting fetus and w/o relocation



Darting w/o Aborting fetus and with relocation



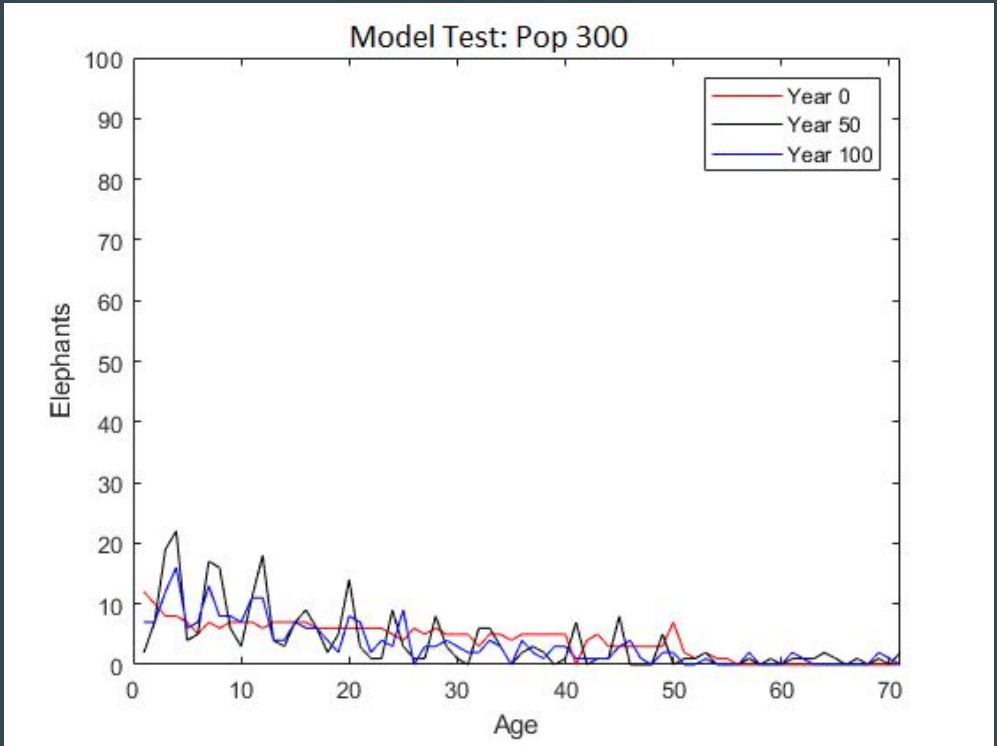
Darting w/o Aborting and w/o relocation



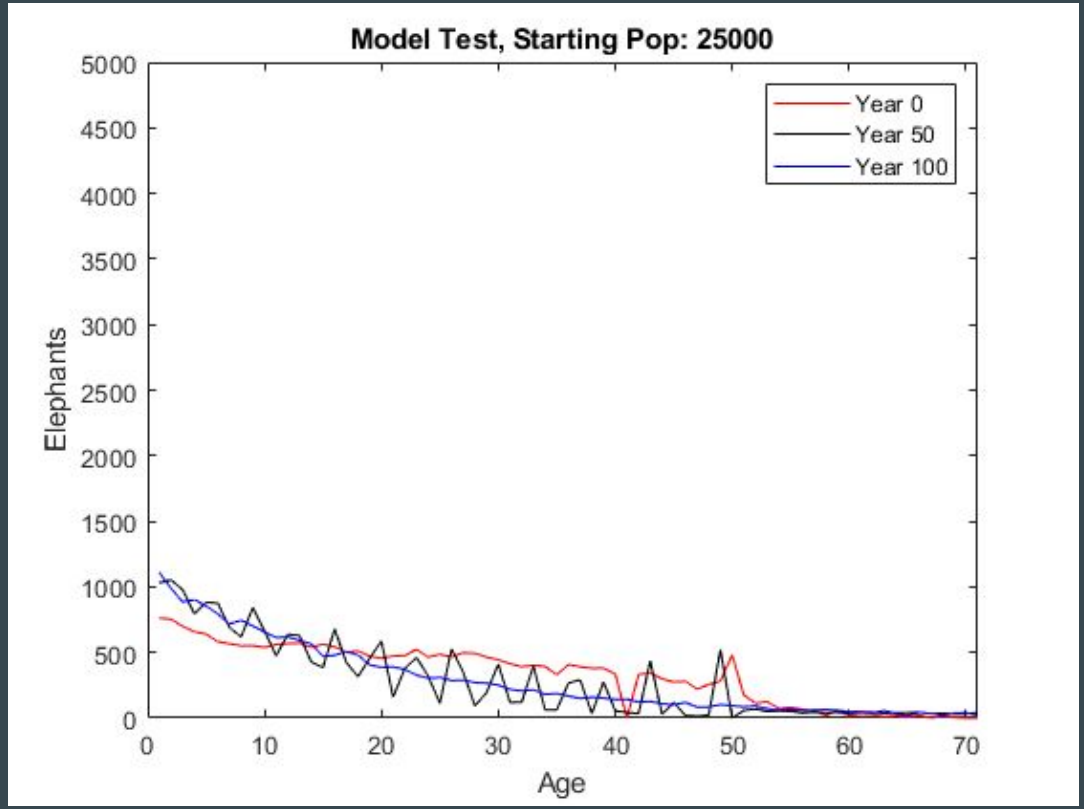
The Chosen Model

- We chose the model which has the following characteristics
  - Darting without aborting the fetus and without relocation was chosen
- This model keeps the population stabilized using logistic darting and no relocation.

Extensibility of our model to Population 300



Extensibility of our model to Population 25000



Conclusion

- Relocation can’t be done every year with the fixed amount of number as that is expensive and sometimes, very dangerous
- The relocation should occur dynamically or should only occur after the desired population has been achieved.

Questions?