Elk Challenge Problem

Seventh and Eighth Grade Math

Developed by:
The teachers, students, and mentors in the
Gaming Research Integration for Learning Laboratory® (GRILL®) Summer 2015

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1. ELK CHALLENGE PROBLEM

Primary Resource: http://www.comap.com/highschool/contests/himcm/2012problems.html

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1.1. INTRODUCTION

Prior to the arrival of European colonization on the North American continent, the ecological bio-diversity was much richer than we currently know in the 21st Century. Prior to the colonization animals such as the American Bison, Eastern Elk, Eastern Cougar, and Wolf were commonly seen across the North American continent. However, with the colonization from the old world came prejudices and practices. Within 250 years, all of these species were eradicated from the Eastern United States or extinct. Over the course of the last century an effort has been made to halt the loss of the North American fauna with the creation of national parks and animal preservation habitats, and in the last half of the 20th century work was done to reintroduce that fauna back to its natural habitat. This process has been used with several different species; however, no species has been given much attention compared to that of the American Elk. Prior to the reintroduction of elk back into Eastern United States, the only attempt at having these animals in their natural Eastern habitat was done by the owners of private exotic hunting preserves. However, new studies have been conducted on the impact of a reintroduction program. The following problems with the reintroduction problem are as follows:

- In what states should elk be reintroduced?
- What would be the impact on agriculture?
- Would the Elk adapt to the more densely populated Eastern U.S?

However, the most pressing question was the elk native to the Eastern U.S was hunted to extinction during the 1800s. The Eastern Elk, while similar to the Manitoba Elk, are not the same. The Manitoba Elk were similar in size than the Eastern subspecies and were adapted to living in the Western U.S. These adaptations included: disease tolerances, foods, and environmental differences. How would these adaptations affect the introduction of Manitoba Elk into the East and more specifically, in the Great Smoky Mountain National Park?

1.2. PROBLEM

Build a mathematical model to determine whether the elk survive or die out. Regardless, come up with a plan to improve the growth of the elk over time. In addition to your summary sheet and complete project report, prepare a letter describing your results to the Commissioner of the Department of Wildlife. The following are reported numbers over the course of the study:

Table 1: This is the numeric data for the population growth and the corollary effects on the growth and culmination into the current approximate population of the herd in the GSMNP region. This is an approximation. Some species were killed off faster than others, with the Eastern Elk being killed to extinction in the early 1800's and the Eastern Cougar being recorded as being killed off as late as 1930s.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Reintroduced	25	27					5				
Births	4	2	10	8	10	13	19	19	19	25	19
Death	x	x	x	x	x	X	x	x	x	x	X
Poached				1					1		
Sickness	1	5	2	6	2			3	2	3	
Accident			1			1	1	1		2	
Predator	1		1	2	5	1	4		2		
Unknown				3				5	3	2	3
Population	27	51	57	53	56	67	86	96	107	124	140

1.3. PARAMETERS

- The farthest west you may introduce the Elk is the western state line of Mississippi.
- Your starting population for reintroduction of Manitoba Elk cannot be greater than 40 and the final population cannot interfere with current existing species in any state.
- Assumptions of predators, sickness, and accidents must be taken into account and reflected in a table write-up.
- Your formula must reflect characteristics of male/female sex ratio, birth rate per year, and the survival rate of newborn elk.

1.4. PROJECT WRITE-UP

- A graph illustrating the actual population of the Elk per year for 10 years
- An equation representing the approximate growth of your Elk population that deals with the change in your start of the year population
- A write-up including the following:
  - An explanation of the problem
  - Interpretation
  - Assumptions
  - Mathematical models (your graphs, charts, visuals, and equations)
  - Conclusion
  - Reflection piece

- Works cited page for research

1.5. RUBRIC

Category	Components	Points Earned	Comments
Calculations	- Equation of Elk growth rate - Male to female sex ratio - Percent of Elk that will give birth - Percentage increase from one year to the next - Graph reflecting the Elk's population for the next 10 years - Equation(s) for food consumed in lbs. per year	/30	
Project Write-Up	- All components listed under "Project Components" are included and explained with visuals, math work, and research	/25	
Solution Presentation	- Presentation of solution is prepared with visuals, is easy to follow, and lasts between 3-5 minutes	/20	
Assumptions	- Any and all assumptions are stated and at the beginning of the appropriate section and explained	/15	
Grammar and Mechanics	- Correct grammar and mechanics - Units are used appropriately - Layout is simple and easy to follow	/5	
Works Cited Page	- All research used in project is found under Works Cited page and is consistent in format	/5	
Total		/100	