Challenge Final Report Submission Information

Team ID-

Melrose Team #35

School Name-

Melrose High school

Project's Area of Science-

Conservation Ecology

Computer language(s) used in your project

Net Logo

Team members grade levels in school (comma separated)-

Freshman

Team member's email addresses (comma separated)-

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Blood Ivory

Supercomputing Challenge

Final Report

April 2, 2018

Team Number 35

Melrose High School

Team members:

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Teacher/Mentor:

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Executive summary:

Our project is about how the African elephant population is affected by the black market trade of ivory. We have been researching how the black market trade of ivory has greatly affected the African elephants. An estimated 100 elephants die every year because of the ivory trade. We have simulated the problem through our Net Logo model. The elephant population is very low now compared to past decades, and this is due to the supply and demand for ivory. If the ivory industry continues to grow elephants will face mass extinction within the next century.

Elephants are a keystone species within their ecosystem. Small animals such as birds and mice depend on their foot prints to collect water, also their foraging affect the growth of any plant species and their subsequent consumers. If the elephants go extinct there will be a major link in the food chain lost. With our model we have shown how the elephants are affected by poachers, and protected by game wardens and by doing so, have shown that steps can be taken to save the elephants.

Statement of problem:

Throughout history, the human desire for ivory has overcome the efforts to stop the trade of ivory. Although a pretty thing to have, ivory comes at a huge cost to the African elephants population. In some countries of Africa including Senegal, Somalia, and Sudan, elephants have already been driven to localized extinction. The peoples of these countries have been killing their

elephants and taking their tusks in order to support the ivory trade. The ivory demand comes from mostly Asian countries such as Japan, China, and Korea that use the ivory for things like jewelry making, piano keys, sculpting, and religious ceremonies.

Many people believe that elephants are just animals with no emotion or feelings. However elephants share the same emotions and cognitive behavior as humans. They grieve for their losses; they feel fear, joy, and empathy. Elephants are a keystone species other animals, plants, and ecosystem depend on their survival so along with their loss goes the ecosystems they help support. Elephants although protected by multiple laws against killing them, are hunted by criminal gangs for their ivory, meat, and babies to be beat into submission for a future life in entertainment or manual labor. If the ivory trade does not stop there will be a mass extinction of the African Elephants.

Method:

We believe that a major way of helping with this problem is by promoting an increased awareness for elephant extinction. We feel we have helped others understand that it is not just elephants that will go extinct, but along with them entire ecosystems, tree species, and small animals.

Our group built a model about elephant ecology. In our model we have created agents representing elephants, poachers and game wardens. The agents are programmed to follow a set

of actions that represent their real-life activities. All of this takes place on a modeled landscape showing a stylized African savannah. The background of the model has large brown areas and some spots of blue and green. The brown are represents the arid regions. In this region the elephants have no protection, food, or water, and the elephants have a bad breeding rate here. Also there is more of a chance that the elephants will be killed while out roaming around, and the poachers also have a higher chance of being caught by the wardens. The blue represents the water, which is needed by the elephants. Green represents the tall grass. In the grass, there is less of a chance that the elephants will be caught and killed by the poachers because there is shelter for them in this region. Also the elephants have a higher breeding rate when they are in this region. The elephants search for grass and water to have more success, and increase their survival rates. The poachers hunt for the elephants and have a chance of making a kill. They then leave with their ivory. And the warden's chase the poachers.

Some elephants may die from natural causes. We have incorporated weather, when weather is bad animals have a larger chance of dying from natural causes more, and less from poachers. When the elephants die from natural causes they are to stamp a green color and die. Our program has mechanisms that set the numbers of all possible agent types, and has ways for their numbers to fluctuate. Besides these main components, we followed some systems made at a review of our project, and added some additional factors.

Verified and validated:

We have had this project for two years now. This year, we have improved it and adding new factors like weather and natural deaths. We have came a long ways since our middle school

years, and this year our project has become more in depth, just like the problem is in real life. We have researched how Ivory trade has increased in the 1970s. Demand of ivory rocketed with 80% of Ivory coming from poached elephants. We have learned how international Ivory trade was prohibited in an attempt to fight this illegal trade. Since records began, 2011 saw the largest recorded black market ivory trade increase. We found that 38 elephants range states were set with the main objective to stop poaching of the elephants but it did not work. We expect to raise awareness of the problem by modeling what can happen. We believe that if people are aware that if the elephants go they will take entire ecosystems with them. They will help in the fight against ivory trade. The usefulness of this is to show people that elephants are a keystone species in large ecosystems and many different species depend on their survival. This model shows how rapid the extinction of the African Elephants could possibly be in our future, but hopefully, it will never be verified by actual extinction!

Results:

We expected to raise awareness of the problem by modeling what can happen, and we did. Many of the people we have spoke to about our project have learned new things. This was also our most significant achievement. We believe that if people are aware that if the elephants go they will take entire ecosystems with them. Informed people will be more likely to help in the fight against ivory trade. The usefulness of this is to show people that elephants are a keystone species in large ecosystems and many different species depend on their survival. This model will show the importance of their survival. We will showed the rate of reproduction, death by disease and poaching, the way the ecosystems change, and how people can slow down their

extinction by decreasing the ivory demand. We are still working on improving our project with more code, and more research.

Acknowledgments:

Iworry.com - A web site that gives info about ivory trade

National geographic - Blood ivory Issued October 2012

Wwf.com - web site that gives info about elephants

I dreamed I was in Africa - book by kuku gullmann

Ivory ghosts by Caitlin O'Connell - book about ivory trade

Net logo flocking program

And our science teacher Mr. D he has helped us tremendously he is very knowledgeable

In the area of net logo programming and has taught us many things.

Code:

```
breed [elephantherds elephantherd]
breed [hunters hunter]
breed [wardens warden]

globals [weather]
elephantherds-own [ health ]

turtles-own
[ flockmates        ;; agentset of nearby turtles
  nearest-neighbor   ;; closest one of our flockmates
  illness]
;; xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

to setup
   reset-ticks
   ask patches [set pcolor 37]
   create-turtles 10 [setxy random-pxcor random-pycor]                    (creates grass, dirt, and water patches)
   ask turtles [repeat 25[RT random 180 FD 1 set pcolor green]]
   ask turtles [repeat 2[FD 1 set pcolor blue] die]
   ask turtles [repeat 25[RT random 10 FD 1 set pcolor green]]
   ask turtles [repeat 2[FD 1 set pcolor blue] die]
```

```
end

to start
wander mate poach law atmosphericconditions death-by-natural-causes    (makes turtles move, poachers poach, wardens patrol, weather change, and illness to kill)
end

to do-job
hunt-persue catch-poacher find-water                    (makes turtles chase each other)
end

to atmosphericconditions
 If random 100 < 80
   [ set Weather 1 print "weather = sunny"]  ;sunny  (makes weather ocur)
 If random 100 < 20
   [set weather 2 print "weather = overcast"]  ;overcast
 If random 100 < 10
   [set weather 3 print "weather = rainy"]  ;rainy

end

to createhunter
  create-hunters hunterpop [set shape "person soldier" set size 2 setxy random-pxcor random-pycor]
  if count hunters < minhunter [ create-hunters 1 [set shape "person soldier" set size 2 setxy random-pxcor random-pycor]]        (creates hunter)
end

to createelephants
   create-elephantherds herdsize [set shape "elephant " set color gray set size 5 setxy random-pxcor random-pycor set health 70]    (creates elephants)
end

to wander
   ask elephantherds [ flock fd 1]
   ask wardens [LT random 60 RT random 60 FD 2]
   ask hunters [lt random 250 rt random 250 fd 1]                    (makes turtles move)
   tick
end

to mate
  ask elephantherds  [ if count elephantherds < 100 [ if (any? turtles-here with [breed = elephantherds])and (random breedrate < 5) [hatch-elephantherds 1] set
health 70]]
end
                                    (makes elephants breed)

to law
  ask wardens [ catch-poacher ]
  ask hunters [if (any? turtles-here with [breed = wardens]) and (random 100 < 40) [set shape "x" set color black set size 1  stamp die]]

  ask wardens [if (any? turtles-here with [breed = hunters]) and (random 100 < 5) [set shape "x" set color black set size 1  stamp die]]    (makes wardens move)
end

to poach                                                                                    (makes poachers kill elephants)
   ask hunters [ hunt-persue ]
   ask elephantherds [ if (any? turtles-here with [breed = hunters])and (random 100 < killrate * weather) [set color red set size 1 stamp die] ask hunters [ die ] ]
end


to police                                                                                   (makes wardens patrol)
 create-wardens 4 [set shape "warden" set size 2 setxy random-pxcor random-pycor]
end
```

```
to hunt-persue
   let possible-prey other turtles with  [ breed = elephantherds ]in-radius 5
   let nearest-prey min-one-of possible-prey [ distance myself ]                                  (makes poachers chase wardens)
   if nearest-prey != nobody [  face nearest-prey ]
   fd 1
end

 to catch-poacher
   let possible-suspects other turtles with  [ breed = hunters ]in-radius 10
   let nearest-poacher min-one-of possible-suspects [ distance myself ]                           (makes wardens chase poachers)
   if nearest-poacher != nobody [ face nearest-poacher ]
   fd 2
end

to find-water                                                                                      (makes elephants search for water)
    let oasis other patches with  [ pcolor = blue ]in-radius 10
    let close-water min-one-of oasis [ distance myself ]
    if close-water != nobody [ face close-water ] fd 1
    let possible-prey other turtles with  [ breed = hunters ] in-radius 10
    let nearest-prey min-one-of possible-prey [ distance myself ]
    if nearest-prey != nobody [  face nearest-prey lt random 180 ] fd 1
    ask elephantherds [ if (any? turtles-here with [breed = hunters]) and ( any? patches with [pcolor = green]) and (random 50 < killrate) [set color red set size 1
stamp die ask hunters [ die ] ]]
    ask elephantherds [ if (any? turtles-here with [breed = elephantherds]) and ( any? patches with [pcolor = green]) and (random 200 < breedrate) [set color red
set size 1 stamp die ask hunters [ die ] ]]
end

to death-by-natural-causes
  ask elephantherds [if random disease-level > health [set health health - 5]
  if health <= 0 [set color green stamp die]]
  ask elephantherds [if random recoveryrate > health [set health health + 5]]
end



;;  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

(makes elephants flock)

```
  to go
  ask elephantherds [ flock ]

  repeat 5 [ ask turtles [ fd 0.2 ] display ]

  tick
end

to flock  ;; turtle procedure
  find-flockmates
  if any? flockmates
    [ find-nearest-neighbor
      ifelse distance nearest-neighbor < minimum-separation
        [ separate ]
        [ align
          cohere ] ]
end

to find-flockmates  ;; turtle procedure
  set flockmates other turtles in-radius vision
```

```
end

to find-nearest-neighbor ;; turtle procedure
  set nearest-neighbor min-one-of flockmates [distance myself]
end


to separate
  turn-away ([heading] of nearest-neighbor) vision
end



to align
  turn-towards average-flockmate-heading max-align-turn
end

to-report average-flockmate-heading

  report atan sum [sin heading] of flockmates
              sum [cos heading] of flockmates
end

;;; COHERE

to cohere
  turn-towards average-heading-towards-flockmates max-cohere-turn
end

to-report average-heading-towards-flockmates
  report atan mean [sin (towards myself + 180)] of flockmates
              mean [cos (towards myself + 180)] of flockmates
end


to turn-towards [new-heading max-turn]
  turn-at-most (subtract-headings new-heading heading) max-turn
end

to turn-away [new-heading max-turn]
  turn-at-most (subtract-headings heading new-heading) max-turn
end


to turn-at-most [turn max-turn]
  ifelse abs turn > max-turn
    [ ifelse turn > 0
        [ rt max-turn ]
        [ lt max-turn ] ]
    [ rt turn ]
end
```