

# **Modeling Hopes for the Future of Wildlife**

NEW MEXICO ADVENTURES IN  
SUPERCOMPUTERING CHALLENGE

FINAL REPORT

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Team 053

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## **Executive Summary**

Much of the wildlife in our Nation is in danger of being extinct. Our team has hypothesized that this is due to the growth in human population over the years. One major finding was that the human effect on tree populations which provide habitat for the owl indirectly affects the overall density of the forest through grazing. To prove our hypothesis we plan to create a model using StarLogo to show how owls and humans respond to each other in the same habitat. After doing research on the Mexican Spotted owl and Human populations in the New Mexico area we hope that we may be able to create a model that shows the cause and affect relationship between the owls and human activity. So far our group has only been able to get pseudo code done for StarLogo code, but we still plan on working with our mentor to have a working program.

## **Introduction**

### **Project Description**

Over time as humans expand certain species of animals seem to decrease. The question is does the increase in human population really affect the population growth rate of species of wildlife. Or does human expansion affect the animals the least? In the first-ever federal census of the birds on public lands in Marin, National Park Service biologists have counted 55 pairs of northern spotted owls ([St. John, 2000](#)).

The problem faced in our project is to create a simulation of the population fluctuations of two endangered bird species and humans in a certain area to see if a pattern is formed. Whether it is a decrease or increase in human or bird populations, or if there should be no relation what so ever. Our goal is to see if the populations should affect each other and if a pattern of interaction should form to see if further decrease in these populations can be prevented.

### **Significance**

The Mexican Spotted Owls are an endangered species in New Mexico. After this experiment is completed the US Fish and Wildlife Services may be able to see how the species has suffered and may suffer with the help of our model and may be able to prevent any more damage. “However, independent research has documented spotted owl populations on the Gila and Coconino National Forests as declining by at least 10% per year between the years 1991-1997. Since the two populations are approximately 200 miles apart, the researchers believe the entire met population may be declining. Unfortunately the scientists have also continued to detect dwindling populations since 1997. Alarmingly, no owls successfully reproduced in the Gila study area last year (<http://www.biologicaldiversity.org/swcbd/species/mso/>).”

## **Spotted Owl Behavior**

The Mexican Spotted Owl lives in habitats of dense wooded areas of mountain. They often lay eggs during March or April. Around 1-3 eggs are laid by the Mexican Spotted Owl during this season.

## **Effect of Human Population on Forests**

Since the dawn of man kind man has learned to adapt to different climates and ways of living. From the coldest regions to the hottest humans can adapt almost anywhere.

During 1900 the population of New Mexico was 195,310 people. During 2000 the population of New Mexico was 1,819,046 people. Difference is 1,623,736 people in 100 years. There was a 930% increase in the population.

## **Circumstances of Trees**

Humans have had a significant effect on forests around the world in recent history. Wherever people find new land they use the trees as fuel, shelter and building material. This has a direct impact on the wildlife that naturally exists in the area. A less obvious effect is the effect that people have on forests by bringing in domestic animals and livestock.

“Today’s forests have changed considerably from what European settlers described during the late 1800’s and early 1900’s especially in the lower elevation forest zones. Most historical writings describe the condition of ponderosa pine forests as much more open than we see today. Early forest inventories from southwestern ponderosa pine

stands indicated an average of 20-40 trees per acre with a fairly even distribution of small to large trees. Trees occurred in groups of similar size and there was considerably more grass and fewer understory trees than we see on many forest sites today. Today's forests often have hundreds of trees per acre, smaller average diameters, dense cluttered understories and little grass ([srwqis.tamu.edu/states/newmexico/environment.aspx](http://srwqis.tamu.edu/states/newmexico/environment.aspx)).

Ponderosa pines have an average of 20-30 trees per acre varying between small and large trees. Ponderosa trees have changed through the years becoming more open with more grass and fewer under story trees. The map in Starlogo will resemble the mapping of the forest described. The trees, however, will remain the same size but the space between they will vary according to the information.

For years Smokey the Bear has taught us that, "only you can prevent forest fires." But nowadays conservationists are teaching children about the benefit of natural fires and we no realize that only "wildfires" should be prevented. Controlled burnes are even used as a way to keep forests healthy. When trees are grown close together, they cannot grow and mature into larger trees in a

much better and wider environment. Thus, their diameters and bark does not grow as strong as the ponderosa trees and they are able to be burned down by a simple fire and grass fuel. So when there is a majority of large and maturated trees, the fire will not spread and cause devastation over the forest. But if there is small trees that are still growing, then the fire will be able to burn them down easily.

Grazing is also a part of deforestation. When settlers came to New Mexico, they brought

with them cattle which ate the grass and made it hard for fire to spread since all the grass was gone. The settlers also cause deforestation with logging to make households.

“Changed forest conditions are believed to be a result of a change in fire frequency and behavior due to past unregulated grazing, careless logging and fire suppression. By studying tree rings and fire scars on old trees and stumps, forest scientists have determined that before the turn of the last century, low intensity fires burned through the grass in ponderosa pine forests every 2-10 years and in the pinyon-juniper woodlands every 10-30 years. These fires left some groups of smaller trees and burned up others. The thick bark of old ponderosa pines was scarred but the trees were not killed. Thus groves of trees were kept open and park like. When eastern settlers began to arrive in New Mexico in large numbers in the 1870’s after the Civil War, they brought with them huge numbers of cattle and sheep and overgrazed the grasses. Lightning-started fires no longer had a grassy fuel to carry them. With settlement came a demand for building materials and railroad ties and many of the trees over 9 inches in diameter were cut. Only the best wood was taken and the treetops and heavy branches were left behind. When these caught fire, the fires were hot and destructive. In response, a policy to put out all fires as soon as possible was implemented and was one of the early missions of the Forest Service, which was started in 1905 ([srwqis.tamu.edu/states/newmexico/environment.aspx](http://srwqis.tamu.edu/states/newmexico/environment.aspx)).”

Forest sizes have been changing throughout the years due to fire, irregular grazing, and careless logging. By studying the rings within a tree’s stump, scientists can determine

how old the tree is and when a fire happened within the forest. The fires that happened over the last century affect the small trees the most by having them burn themselves and other trees around them. The ponderosa tree had fire burns on the tree's bark but was not burned up entirely.

“Trees in crowded conditions mature at smaller diameters and cannot provide some of the ecological benefits of larger diameter trees. Larger trees provide long-lasting habitat for tree dwelling wildlife. Larger trees continue to provide benefits smaller trees cannot even after they have died and fallen. Large fallen trees can provide habitat, hold moisture, reduce soil erosion, and allow other vegetation to become established. They can survive ground fires that would consume smaller logs and continue to provide benefits for decades in dry environments ([srwqis.tamu.edu/states/newmexico/environment.aspx](http://srwqis.tamu.edu/states/newmexico/environment.aspx)).”

### **Method of Solution**

In order to accomplish our goal we have done research in order to find out the populations of the Mexican Spotted Owl and New Mexico over a period of one hundred years. With this information we plan on creating a model using starlogo in order to see how humans have affected the spotted owl and how they may affect the owls in the future.

### **Math Model**



We hope to model this type of habitat using the resources we have on StarLogo. The owls often lay clutches of one to three eggs between March and April. In our model, though, we will change these properties so that an owl will lay a clutch once it has found a suitable home. This home will provide 'energy' for the owl and it shall be able to stay in the tree for the duration of its lifetime or until an outside force (the humans) cut the tree down. If the owls do not find a suitable tree in time, however, their energy will fail them and they will die. Once an owlet is born they will have to have the task of finding a new tree to live in if the old tree is already occupying too many owls or if again an outside force should come and cut the tree down. The owlet will also be given a limited amount of energy in order to maneuver to a new home.

### **Pseudo Code**

Observer Procedure

    Create turtles

If owl < reproductive pop.

    (assume 2)

then print out "pop. Extinct"

else if reproductive pop. > or = 2

    then if tree > =1

Owl = 3 eggs

Turtle Procedure

Create owl

Create tree

Setup: Max # of trees 15-25 = healthy population of ponderosa all in one acre.

(Assume that all trees are mature and that 10 trees hold 1 breeding pair.)

Trees from 1 < 25 (Tree button)

(Fire Button)

If there are less than 25 trees on the screen then the fire is not destructive fire and the trees increase by 5.

If there is more than 25 trees then the fire is destructive and the number of trees decrease by 10.

(Logging Button)

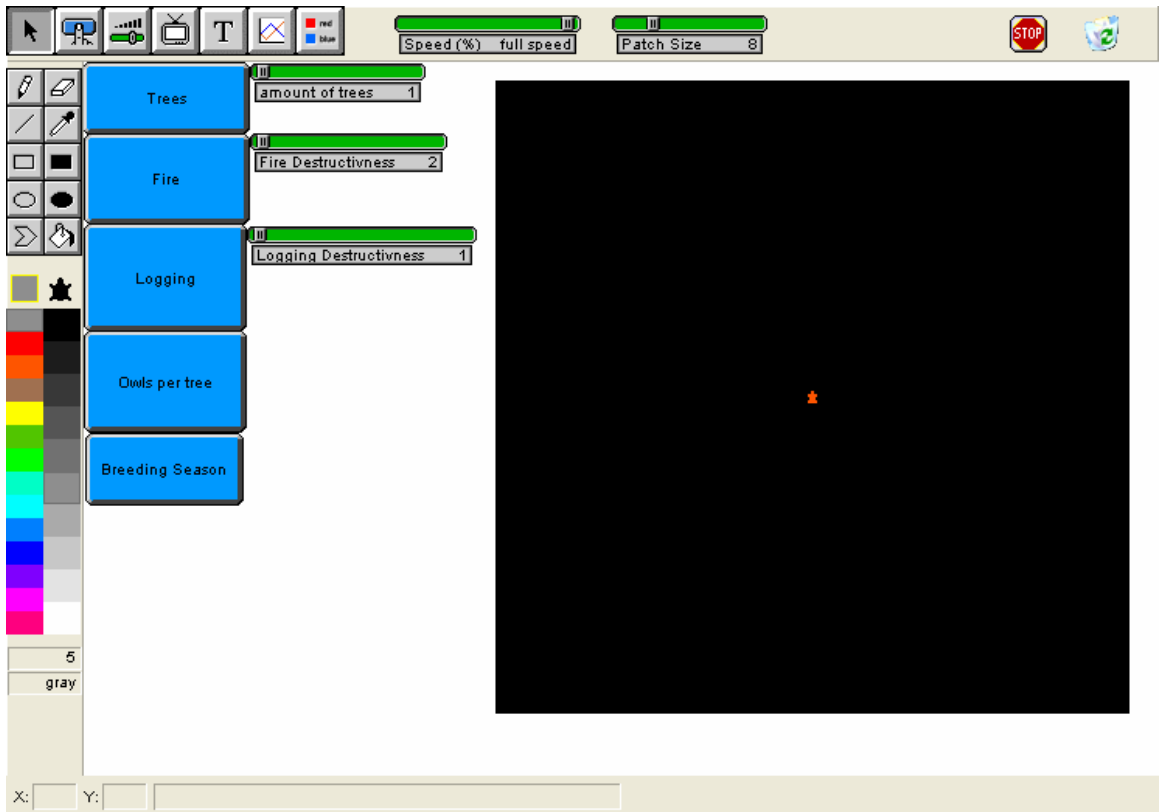
Must only use trees 10 years or older

if remove <3 trees every 5 yrs then sustainable growth.

If remove > or 3 trees every 5 yrs then owl population will decline by how many trees are left.

(Grazing Button)

Decrease grass fewer good fire. More bad fires due to prevention.



## **Conclusion**

Mainly research has been done for this project so far but much practice has been done for this project as well so all that is left to do is do a bit more research and implement the program.

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