Owl, Rat, and Grass Chain of Life

New Mexico

Supercomputing Challenge

Final Report

April 2, 2008

Team # 60

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Executive Summary

Our experiment investigates how the food chain of spotted owls, wood rats, and grass interact. The purpose of our project was to create a model and evaluate how a food chain works and what happens when something drastic happens to one of the species involved.

Our hypothesis was that the food chain will be able to sustain itself, and there will be an impact on all the species, but also their populations will increase and decrease forming a circle. When the owls are decreased by humans, the wood rats thrive. Then the wood rats consume more grass making the grass die. When the grass dies the wood rats decrease, making the owls decrease again and then the process will just continue on.

We made a model of the food chain cycle on Star Logo. Then we added another variable, traps, to represent hunting. We experimented with the program to see if it would be able to sustain itself when part of its chain was being destroyed. We also wanted to see the effects on the other species. The simulation shows the difference between hunting and no hunting. We ran the simulation under different conditions. We watched the results of the simulation on the screen. A line plot showed how many wood rats and spotted owls there were.

Our results found that the more traps there were, the more spotted owls were killed. That means that the wood rat population increased, so they ate more grass.

Purpose/Questions

The Spotted Owl is a nocturnal predator, and everything about its form is adapted to that purpose. The main prey of the spotted owls is wood rats. Wood rats have other predators as well but the main focus of our experiment is on how they interact with spotted owls. Our experiment will investigate how the food chain of spotted owls, wood rats, and grass interact.

Question:

1. Will the food chain be able to sustain itself while spotted owls are being trapped and hunted?
2. What happens to each species (spotted owls, wood rats, and grass) when the spotted owls are being hunted

Hypothesis

1. We believe that the food chain will be able to sustain itself but there will be an impact on all the species, but also their populations will increase and decrease forming a circle. When the owls are decreased by humans, the wood rats thrive. Then the wood rats consume more grass making the grass die. When the grass dies the wood rats decrease, making the owls increase again and then the process will just continue on.

2. We believe that the spotted owl population will slowly decrease and while they decrease they will eat less of the wood rat population making the wood rat population increase in size. As the wood rat population increases they will consume more of the grass so the grass will die down in size.

Project Resources

Computer

Starlogo software

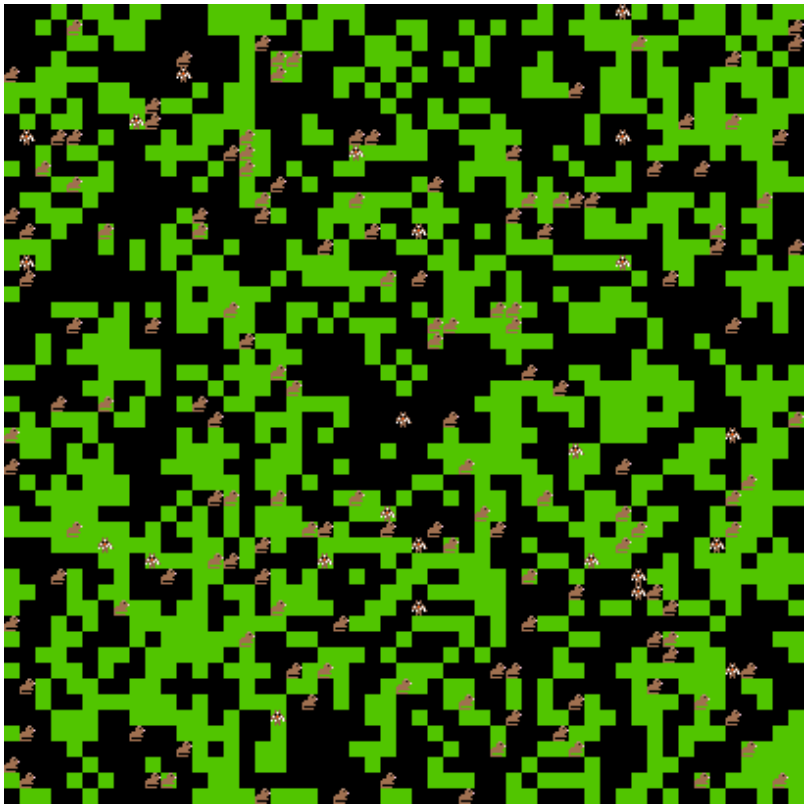
Brain

Method

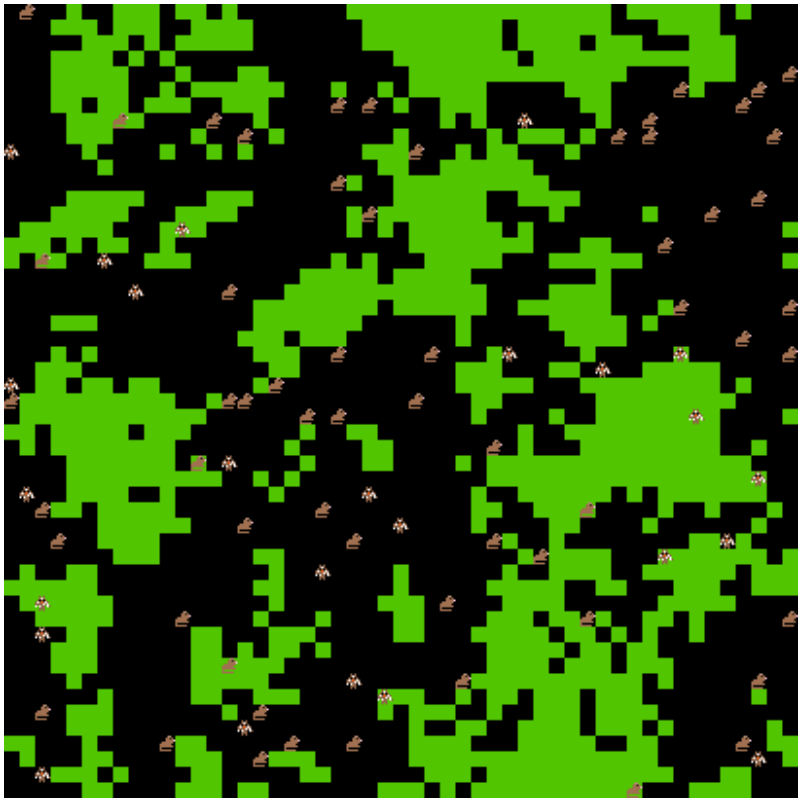
First we consulted our mentor about threatened species in New Mexico. Next, she helped us choose to study how the spotted owl and wood rat food cycle is affected by hunting. We studied these animals. Finally, we programmed a simulation of the situation on Starlogo.

Results

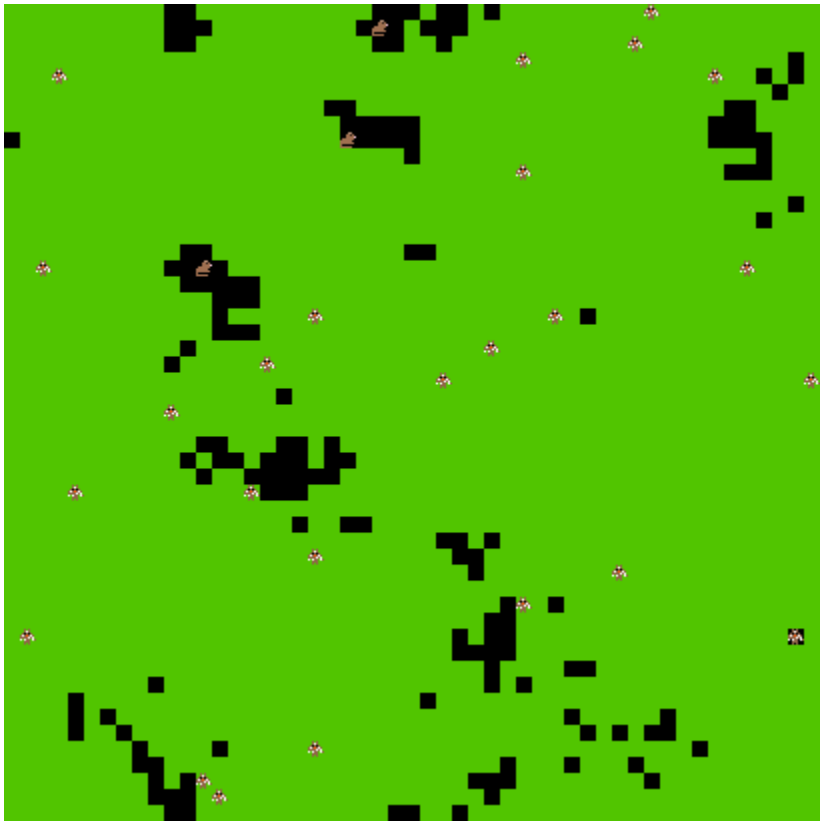
We used the graphics from the simulation to determine what happened to the owls, wood rats, and grass. Our results showed that the more traps there were, the more spotted owls were killed. That means that the wood rat population increased, so they ate more grass. Hunting upsets the interaction between the species, possibly annihilating one of the species.



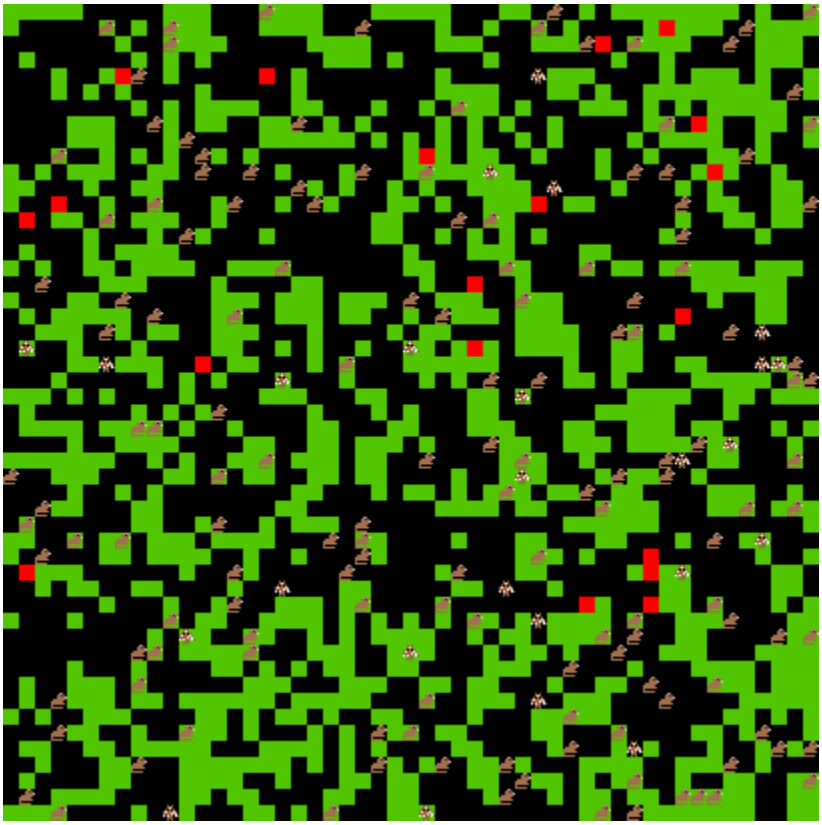
Beginning (no traps)



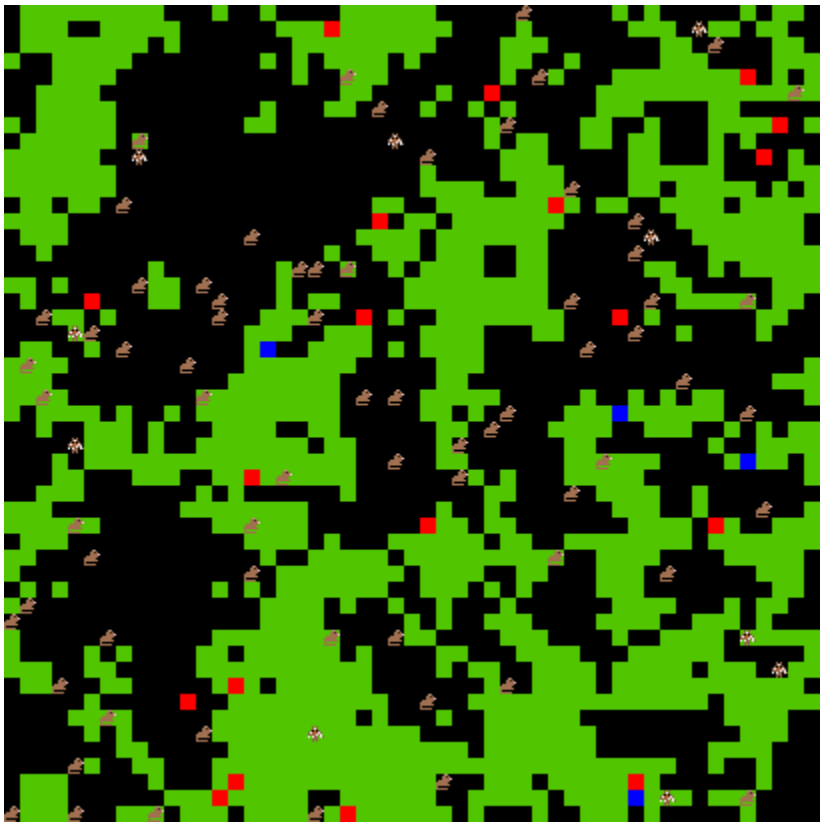
Middle (no traps)



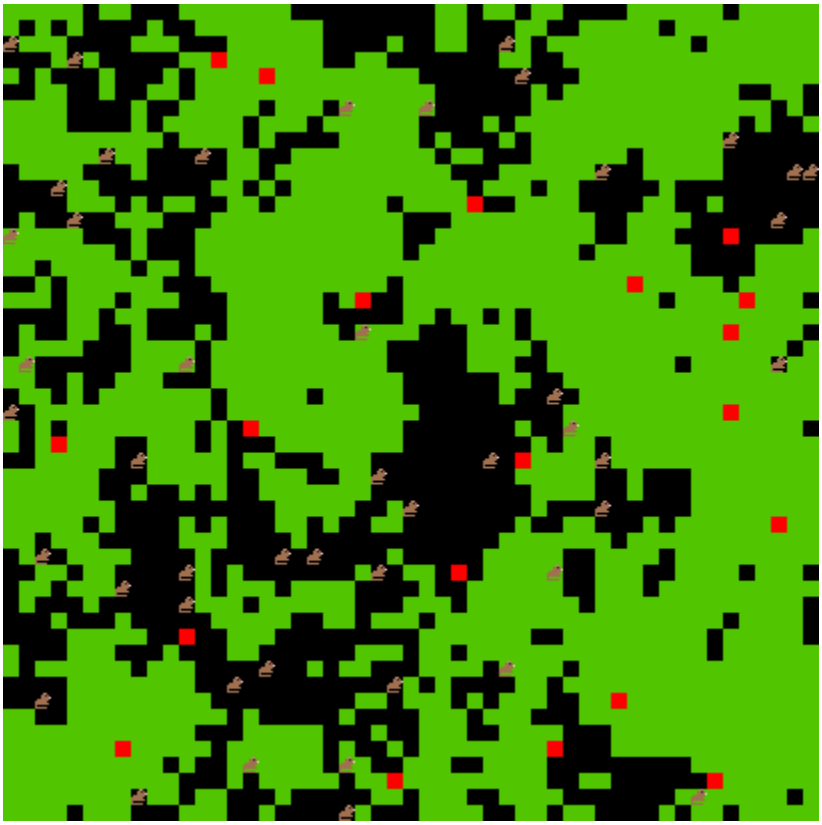
End (no traps)



Beginning (traps)



Middle (traps)



End (traps)

Conclusions

1. Our hypothesis was that the food chain will be able to sustain itself but there will be an impact on all the species, but also their populations will increase and decrease forming a circle. When the owls are decreased by humans, the wood rats thrive. Then the wood rats consume more grass making the grass die. When the grass dies the wood rats decrease, making the owls decrease again and then the process will just continue on.

Achievements

- We simulated an ecosystem using knowledge from our mentor and references and Starlogo software.
- We investigated the effect of human interference on an ecosystem by including hunters and traps in our model.

Bibliography

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Acknowledgements

Leslie Hansen, Los Alamos National Laboratory, is a wildlife ecologist and was our subject matter expert.

Jim Wendelberger, Urban Science Applications, has a background in computer programming and helped us learn about Starlogo.

Leanne Salazar, Los Alamos Middle School, is our teacher and encouraged our supercomputing efforts.

Appendix A: Starlogo Observer Procedures

```
globals [grassenergy woodratenergy spotowlenergy]
breeds [woodrats spotowls traps]

to setup-grass
  crt number + grass-rate
  ask-patches [if (random 100) < 25 [setpc green]]
  ask-turtles [setup-grass]
  clearplot
end

to setup-traps
create-traps numbertraps
ask-traps [setshape square-shape setc red]
ask-traps [repeat 100 [seth random 360 jump random 100]]
end

to setup-woodrats
create-woodrats numberwoodrats
ask-woodrats [setshape woodrat-shape]
ask-woodrats [repeat 100 [seth random 360 jump random 100 setwoodratenergy random 10]]
end

to setup-spotowls
create-spotowls numberspotowls
ask-spotowls [setshape spotowl-shape]
ask-spotowls [repeat 100 [seth random 360 jump random 100 setspotowlenergy random 10]]
end

to setup-all
ca
setup-grass
setup-traps
setup-woodrats
setup-spotowls
end
```

Appendix B: Starlogo Turtle Procedures

```
turtles-own [species [grass]]



to setup-grass
  setxy random screen-width random screen-height
  ifelse who < grass-rate
   [setc black ht setspecies grass]
   [setc random 140 ht
    setgrassenergy random 10]
  repeat 20 [grow]
end

to grow
  if breed = woodrats [stop]  ;woodrats turtles don't grow grass
  if breed = spotowls [stop]  ;spotowls turtles don't grow grass
  rt random 10 lt random 10
  fd 1
  if pc-ahead = green [stamp green]   ;grass only grows near other grass
end

to move-woodrats
 if breed = woodrats [if [pc-at = green] [setwoodratenergy woodratenergy + 1 stamp black]]
 if breed = woodrats [if [pc-at = black] [setwoodratenergy woodratenergy - 0.5]]
 if count-woodrats-here * count-spotowls-here > 0 [kill one-of-woodrats-here setspotowlenergy
spotowlenergy + 5]
 if breed = woodrats [seth random 360 fd 1]
 if count-traps-here * count-spotowls-here > 0 [kill one-of-spotowls-here stamp blue]
setwoodratenergy woodratenergy - 0.25
 if breed = woodrats [reproduce-woodrats]
grow
end

to move-spotowls
  if breed = spotowls [seth random 360 fd 2 setspotowlenergy spotowlenergy - 1]
  reproduce-spotowls
end

to move-all
  move-woodrats
  move-spotowls
end

to reproduce-spotowls
  if spotowlenergy > spotowlhatchthreshhold [setspotowlenergy spotowlenergy / 2 hatch []]
end

to reproduce-woodrats
  if woodratenergy > woodrathatchthreshhold [setwoodratenergy woodratenergy / 2 hatch []]
end

to takestep
  rt random 50
```

```
  lt random 50
  fd 1
end

to death
  if woodratenergy < 0 [die]
  if spotowlenergy < 0 [die]
end
```