Pasture-ization

New Mexico

Supercomputing Challenge

Final Report

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Team Number 85

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A special thanks to Mike Daugherty

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Executive Summary

We have used Starlogo TNG to determine what number of cattle a full section of pasture grass will support. We want to solve this problem because a person in an agricultural career, a rancher for example, would need to know this to correctly calculate his stocking rates. Stocking rates are the amount of cattle a rancher can graze on a pasture without overgrazing it. Overgrazing is when all the grass is grazed off a pasture, thus making this pasture unusable. Correctly calculating stocking rates can be important to a rancher in the long run because it will bring more profit.

If the stocking rate is too low a rancher is not getting the most out of his pasture, and he is not bringing in as much profit. If the stocking rate is too high, the rancher over uses his land, and does not have grass for the next year. Also, if stocking rates are correct, the rancher's animals are not starving. This project will help ranchers find the thin line between over stocking and under stocking their pastures.

For years ranchers have been calculating stocking rates by trial and error. This model will help make calculating stocking rates quicker, more accurate and with less chance of failure. If a rancher failed in calculating his stocking rate using the old method, he could overgraze his land. This could start a domino effect starting with the rancher losing his cattle crop and end with possibly losing his land and his home.

The variables that effect stocking rates are A. herbivores besides the ranchers stock, which will eat his pasture grass and B. the size of his pasture. Our model does not include these variables. Our model does not include these variables because we determined though our research, that those variables would not affect the pasture greatly unless that pasture has already been overgrazed. Also, rates aren't dependent on the pasture. They are calculated by the acre. Variables that our model includes are rainfall, energy level, number of cattle, and amount of grass.

Method

We have used a computer to solve this problem by creating agents cattle and grass then adding the variables mentioned above in Starlogo TNG. The model basically calculates the stocking rate based on the amount of cattle, grass, and rainfall.

We have used Starlogo TNG to solve this problem. Starlogo introduces building blocks to make a computer model. Starlogo TNG sequences logic using building blocks. We have had no past computer programming experience; however we have both worked with computers, so we are just learning the vast uses of Starlogo TNG. Before we started this project, we knew nothing about computer programing or how a computer worked. Now we are beginning to understand the complex system of computer language. We know that changing the tiniest thing can result in a totally different outcome.

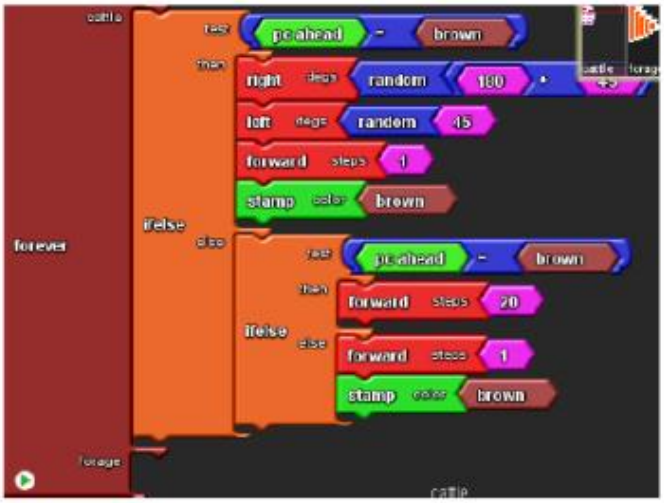
Our project is based more on logic instead of mathematical figures. The logic we used in our project was based on how cattle move and consume grass. We programmed the cattle to move randomly, with no established patterns. Then we programmed the cattle to stamp the patches they walked over brown to represent the consumption of grass. Next we programmed the grass to grow by creating an agent that moves across Spaceland, hatches, and then stamps the patches brown. Then we made a collision for the grass and cattle. In this collision, when cattle consume grass, the size of the cattle increases by one hundredth and the grass size decreases by 1.

Our group worked as a team to complete this project. We divided jobs to get things done faster. One partner did most of the research. He researched how fast grass grows, how much grass cattle eat in a day, and average rainfall in our area. The other partner did most of the actual computer programming, based on the research done. Even thought we divided jobs, we worked together. We have not made as much progress as we had hoped this year, but we got our model to do what we wanted it to do. The progress we did make this year was slow and steady, overcoming obstacles as we went.

Results

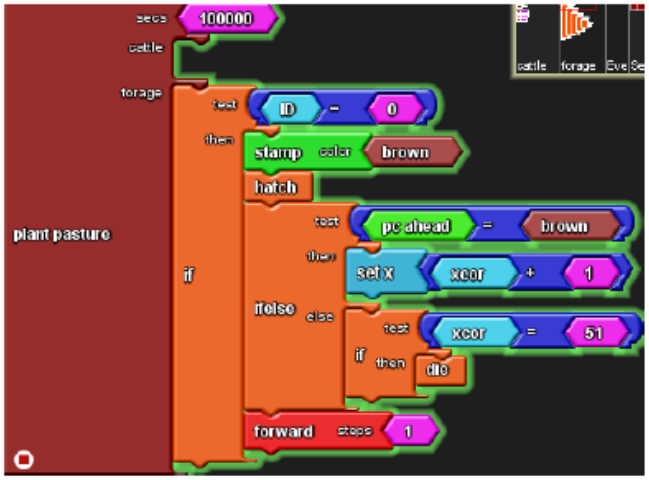
The results of this project are if there are low amounts of cattle and high amounts of grass, the longer the cattle will be supported on that grass. If you have more cattle on less grass, the cattle will not be supported as long. However both outcomes depend on rainfall amounts. If you have fewer cattle on more grass with frequent rains, the longer the cattle will be supported. If you have the same situation with little to no rain, cattle will not be supported as long. If there are more cattle on less grass and it rains frequently, cattle will be supported there a little longer than the same scenario with little to no rain.

Screen Shots

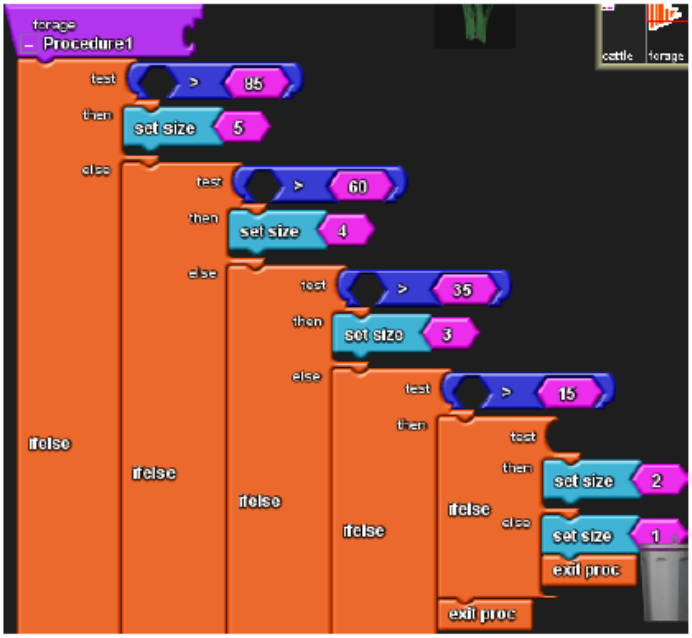


- This programming is for movement of cattle and consumption of grass by the cattle.

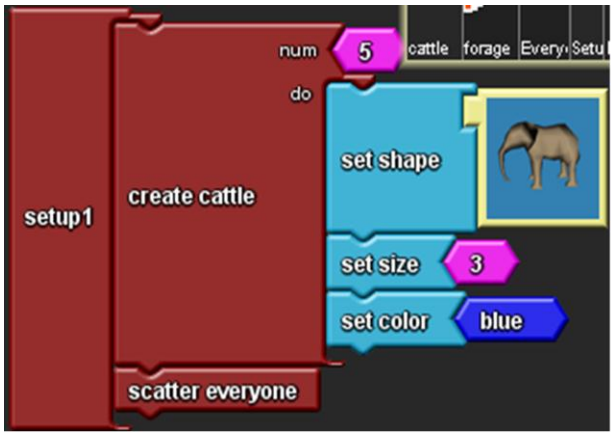
These sliders regulate the amount of rainfall, cattle, and grass.



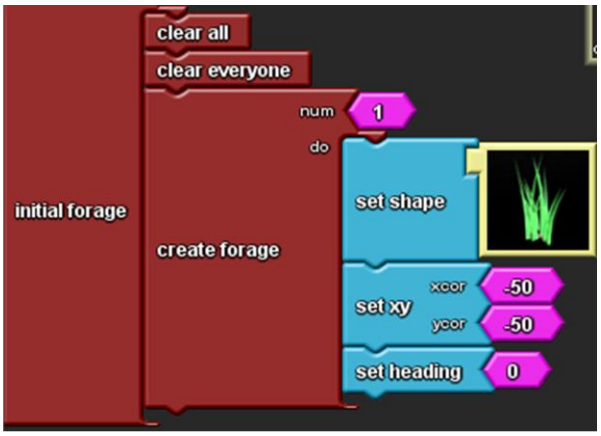
This is the programming that makes the grass grow.



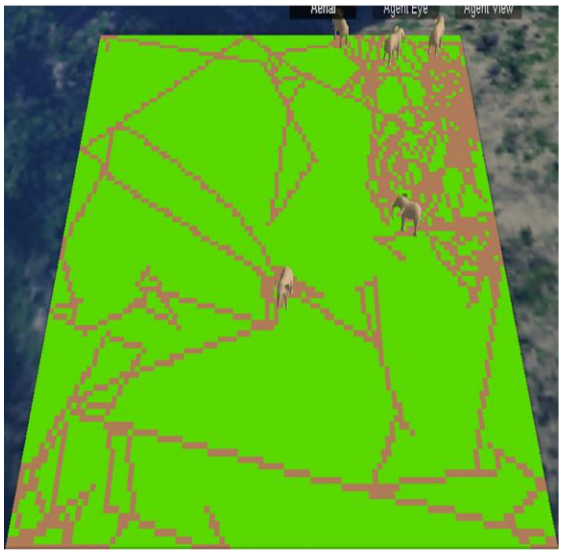
This is the procedure that sets the size of the grass.



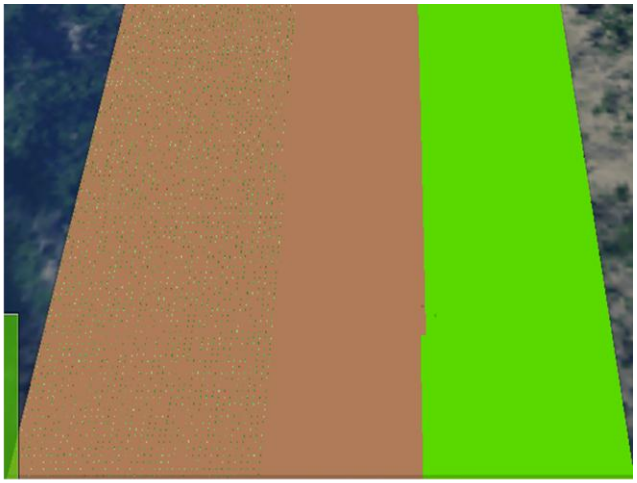
This programming creates the agent cattle.



This programming creates the agent grass, or initial forage.



- This screen shot shows the cattle eating the grass.



This collision represents what should happen when cattle consume grass.

Final Words

We realize there is much more that we could add to this project. Especially the dollar values associated with economic modeling. However, we would have to do that at another time as we gain programming experience.

References

Bermuda grass seed for pastures. (n.d.). Retrieved from http://www.bermudagrass.com/

Grazing. (n.d.). Retrieved from http://www.biologicaldiversity.org/programs/public_lands/grazing/index.html

Climate of new mexico. (n.d.). Retrieved from http://weather.nmsu.edu/News/climate-in-NM.htm