Dynamic Complex Cretaceous Era Ecosystem Simulation

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Background and Introduction

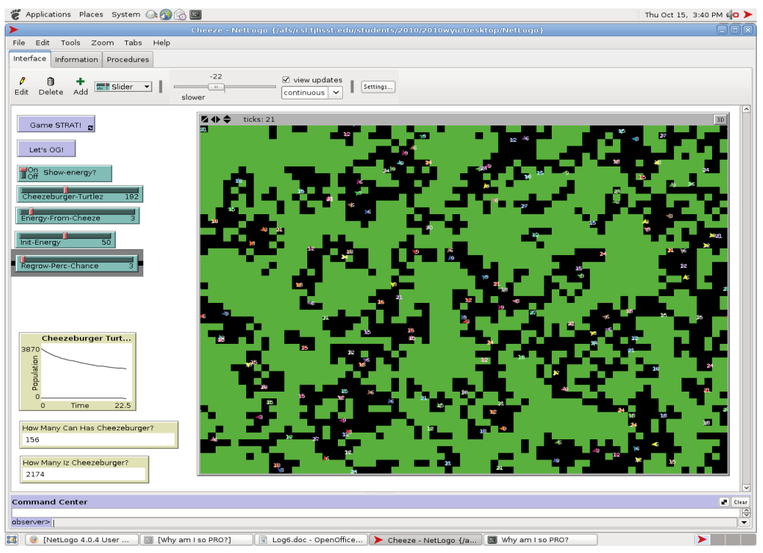
The purpose of my research project is to create a simulation of a many-species, non-static, many-variable ecosystem based on the dinosaurs, focusing on the late Cretaceous Period. According to user preferences, many desired ecosystem simulations will be able to be run. This means that the simulation will expand to cover many hypothetical situations, which will be applicable to real-life, and a real-world model. There are many applications such as recreating events in the distant past as discovered with dinosaur-based research subject studies like paleontology. Other applications include dinosaur research and drawing various individual and independent conclusions and uncovering possibilities based upon these accurate simulations. The simulation will use a chance-based predator and prey ecosystem with a gradually expanding non-symmetric food-chain, reproduction algorithms for evolution, adaptation algorithms, trait accumulation, new species, and natural disasters. One of the most important factors of all, time has already been implemented and is in use well within the program. Each individual specie will age, have conditions, and have limits to behavior. Specie variability is also a close probability in regards to traits such as survival rate. The ultimate goal is to maximize the representation of the simulation by accounting for as many factors as possible. This will first be done in NetLogo to facilitate display/debugging/testing, then will possibly be moved into Python for a more applicable and general programming language. Data will be complied using a spreadsheet and then sorted appropriately.

Design

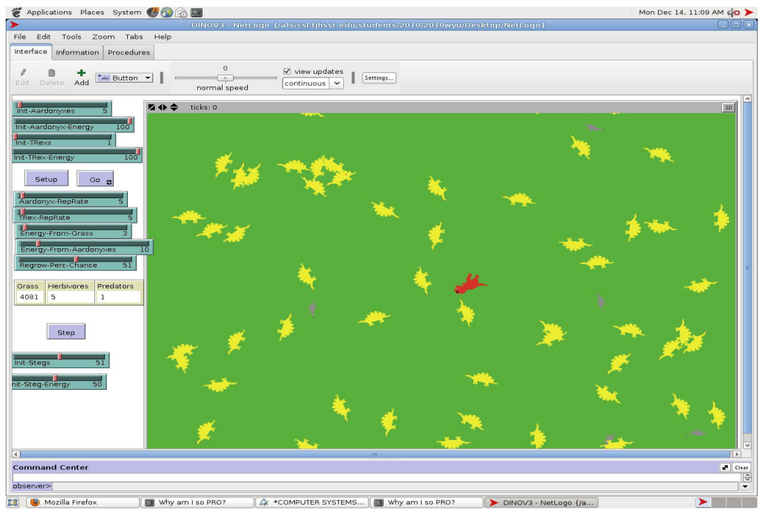
In order for my program to achieve its working goals, it must implement at least a base set of variables that can be manipulated to the user's needs. The most basic of all my variables will be species - there will be producers, consumers, omnivores, etc. Ideally, it will be able to control the number of these species to a certain degree (5-10 species is the desired amount) and also control the populations. Next, expansion will occur by introducing a trait factor for each of the species. According to the theory of natural selection, this will be like a real-world ecosystem and continually improve the existing populations because those with unfavorable traits would become nonexistent. The trait passing algorithm will be based upon the Punnett square (a simple matrix) and a survivability factor. In addition, various natural disasters will be implemented, along with population characteristics. Natural disasters are the catastrophic events that effect the ecosystem, and the characteristics of the different species will mean that different natural disasters affect each species differently. Time is one of the major new implements to my project. Over time, dinosaurs can lay eggs given at least one mating partner and eggs take time to hatch. These eggs may be preyed on and if they survive a certain amount of time, they hatch and become little dinosaurs. Over time, dinosaurs begin to get bigger and bigger according to the size variable, eventually culminating in an age-based death if they manage to survive long. Additional species of different types can be added with little difficulty and are finding their own way into the ecosystem. The simulation counts the various aspects of its agents, with a heavy consideration for the agent count.

Results and Conclusions

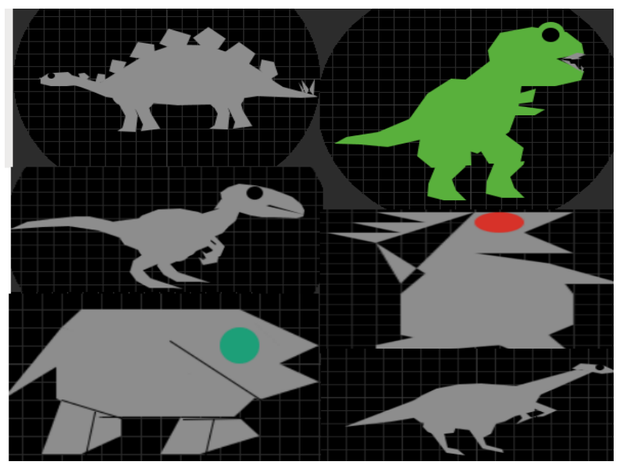
The expected behavior / results of my simulation will probably be indicative of the normal standards of population behavior or conventional ecosystems today, when certain stresses or variables are predominant (for example, the theory of natural selection). The simulation should run reasonably given its inputs and the characteristics known about the various species of dinosaurs.

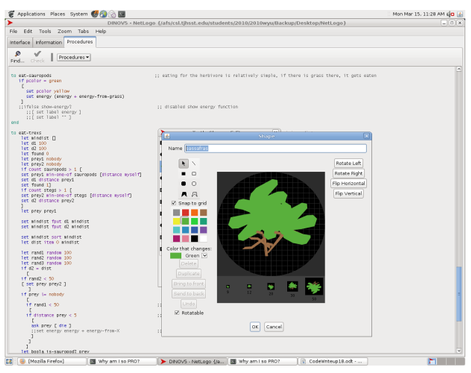


An earlier version of the project with a simple ecosystem focus. The 'turtle' objects are a predator and a herbivore. Black patches signify empty grass lots.

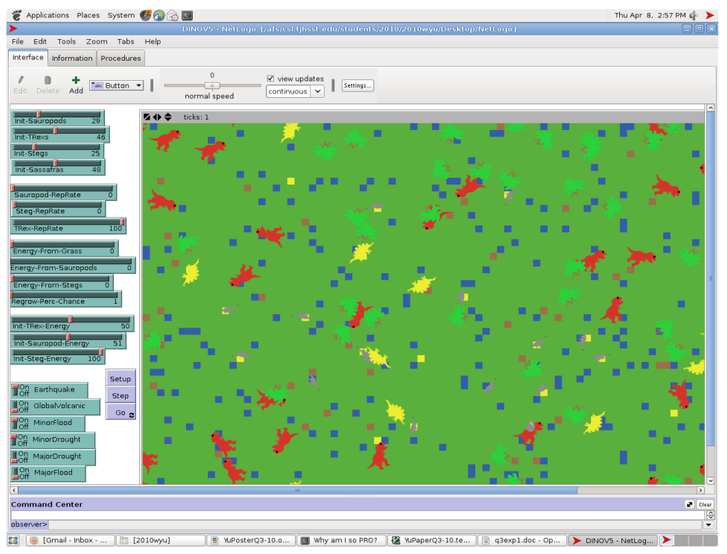


A later version of the project with a focus on late Cretaceous dinosaur simulation. 2 of 4 species are displayed.





Examples of agent types or turtles. These are individually represented in the simulation.



This is the current working version, complete with egg creation, new agents, and environmental events.