

Project Proposal Final 1 1st Quarter 2008

Computer Systems Project Proposal - September 2008

1. Title (or subject area) of the project

Modeling the Tragedy of the Commons Through Agent-Based Modeling

Josh Lee, period 3

2. Purpose and scope of the research project

* goal and scope (extent)

The Tragedy of the Commons is a social dilemma in which a community shares and takes from a common pool of resources. The 'tragedy' inherent in the situation is that when the individuals behave according to those choices which are most advantageous to themselves, the community ultimately suffers. When an individual takes from the community pool of resources, the individual enjoys the full benefit of the resource, while the community shares the cost. Thus, the benefit of taking far outweighs the cost for any particular individual. Many of the individuals behaving in this way, however, will eventually lead to the depletion or near-depletion of the resources.

I hope to model this situation using agent based modeling. Specifically, I intend to model The Tragedy of the Sahel, a real-life situation. My model will consist of grass, cattle, and people. Grass grows at random while cattle and people reproduce whenever they have sufficient energy. Cattle consume grass for energy, people consume cattle for energy. By graphing the grass, cattle, and people populations, we see that these populations vary directly with one another. Greater amounts of grass leads to greater amounts of cows, which leads to less grass being available for each cow, which leads to fewer cows. Thus, as grass goes up, cows go down. A similar effect happens between cattle and people. The point is that the environment 'corrects' imbalances by killing cattle and people.

3. Background and review of current literature/research in this area.

* List any preliminary background reading you've done so far, include other research or projects that have been done before in this area.

I read one article which discussed the Tragedy of the Sahel. This article defined the tragedy of the commons, illustrated its components through simpler examples and feedback loops, and then brought those concepts together to illustrate the Tragedy of the Sahel.

I read a second article discussing the tragedy of the commons and a particular attitude in attempting to solve it. The paper establishes the tragedy in basic, human-related terms: people undergo work to survive, and require energy to do

this work. An *ideal* situation would be: the maximum amount of goods for the maximum amount of people. However, these two goals are direct odds with one another and are together an impossibility. The optimum for a society would involve a specific population-resource ratio, and would require that no individual in the society would take a greater (or lesser) cut than necessary to sustain the society at the same population level. Obviously, this is a "moral" issue for societies to deal with, and not one which can be solved simply through the implementation of technology.

4. Procedure and Methodology.

* What language(s) will you use?

NetLogo code

* What kinds of testing can be done for verification of your project's performance?

If my program incorporates reasonably realistic behavior into my agents (cattle, people, grass) and then graph their populations, there are certain growth patterns expect to see. Namely, the populations should vary directly and inversely with one another. The environment may be tweaked to produce different effects. For example, setting grass to provide greater amounts of energy to the cows should result in greater population fluctuations over time.

5. Expected Results & Value to Others

* What results do you expect to obtain from your project, and how can these results and analysis be presented? What sorts of visuals can you use? If the project were completed, how do you imagine it will perform?

I can graph the grass, people, and cattle populations. As I can design my program to represent certain variables visually, I can visually display these inputs and population graphs to represent the result of changing those inputs.

Ultimately, the point of my project should be to determine a practical (ie realistically implementable) solution to the tragedy of the commons. This, according to my literature review, this would mean creating an environment with stable (not constantly growing and diminishing) populations. This, I expect, would become increasingly difficult to do with increasingly large populations and increasing amounts of available resources. The point is to maximize population sizes and resources while keeping populations stable.

Additionally, even if I were to achieve this now, my model is currently far from realistic. Ideally I would also be able to implement other real-world factors, such as technology in the form of water (not rain) and medicine.