Utopia

New Mexico

Supercomputing Challenge

Final Report

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Team 058

Young Women in Computing

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Executive Summary

One of the most ancient and widely debated questions is "What constitutes a perfect society?" Team Utopia aspires to create the perfect model for other countries to analyze and emulate. We took the complexity out of creating a society and simplified it into four major components: health (which include government funding and sanitation of the society), natural resources (such as raw materials, consumable water, timber, etc.), law enforcement (represented by cops), and morality (shown by the criminal activity). We adjusted our variables into certain trials. In our first trial, we created our control by showing, without unexpected variables, how our model would create the classic logistic curve. In our next few trials, we adjusted the populations of citizens, cops, and criminals, and used the most recurring graphs for analyses. After adjusting population, we adjusted the health and availability of natural resources. Without natural resources, we discovered that a society cannot be sustained. Natural resources provide materials needed for money, exports, and survival, and without these components, a society cannot thrive. To our surprise, we discovered that a country was able to function without government funding in health or sanitation. We concluded that this scenario was present in older civilizations, where communities were able to function and reproduce without large, centralized governments (which include all types of governments: monarchies, republics, democracies, autocracies, etc.).

Problem Statement

Denizens of the United States thrive while those in Bhutan struggle to survive. What factors contribute to such extremities amongst societies? Because of the expanding gaps and widening margins between countries, Team Utopia aspires to bridge these gaps by analyzing and adjusting detrimental features of a civilization to ameliorate the quality of living in all neighborhoods. With our models, we hope to give countries an opportunity to emulate our scenarios and to prosper as idealized communities.

The perfect society is a highly controversial and subjective topic. Theorists from Erasmus to Raskolnikov--in his Napoleonic theory--have all contributed to the factors that would create a utopia, yet the attributes are still being debated today.

Charles Fourier is a great example of a utopian socialist who envisioned a community called a "phalanstery." His model was extremely specific: 1,620 people would live together on 3,000 acres, and tasks would be rotated among citizens (rather than individual citizens specializing in their talents). Inevitably, the phalanstery had several flaws: what happens when a family has too many children? Are the children to be isolated as well? How would a growing population be able to live off only 3,000 acres of land? The conditions of the society would not be maximized to be the best—no specialization in tasks provides such evidence.

Yet other theorists like Karl Marx and Adam Smith conceptualized completely different ideas. Adam Smith preferred a free market ("laissez-faire") as opposed to Karl Marx's and the

socialists' ideas of "equal distribution." Thomas Hobbes believed that people should surrender their rights in order to ensure their safety, but John Lock advocated the rights of life, liberty, and property.

So the question emerges: what are the fundamental elements of a functioning society, and in what ways can we objectively adjust key features so the community can be controlled into a utopia? How can we shrink the gap between the developed and developing countries?

Methods

The perfect society is convoluted. It is abstract. In order to create a concrete visual of our utopia, we simplified our attributes into general variables. After collecting and comparing data—economic conditions, population growths, and healthcare systems—about and between countries on both ends of the National Power Index (NPI), we have integrated law enforcement, criminal activity, health/sanitation, and raw materials into our code. The simplification of overly-complex ideas has allowed us to observe to what degree each attribute affects a population.

Our law enforcement, criminal activity, and citizen count are controlled by the slider in NetLogo. From selecting certain amounts of criminals, citizens, and cops (who represent the enforcement of the law), the plot shows us the relationship between criminals, cops, and citizens.

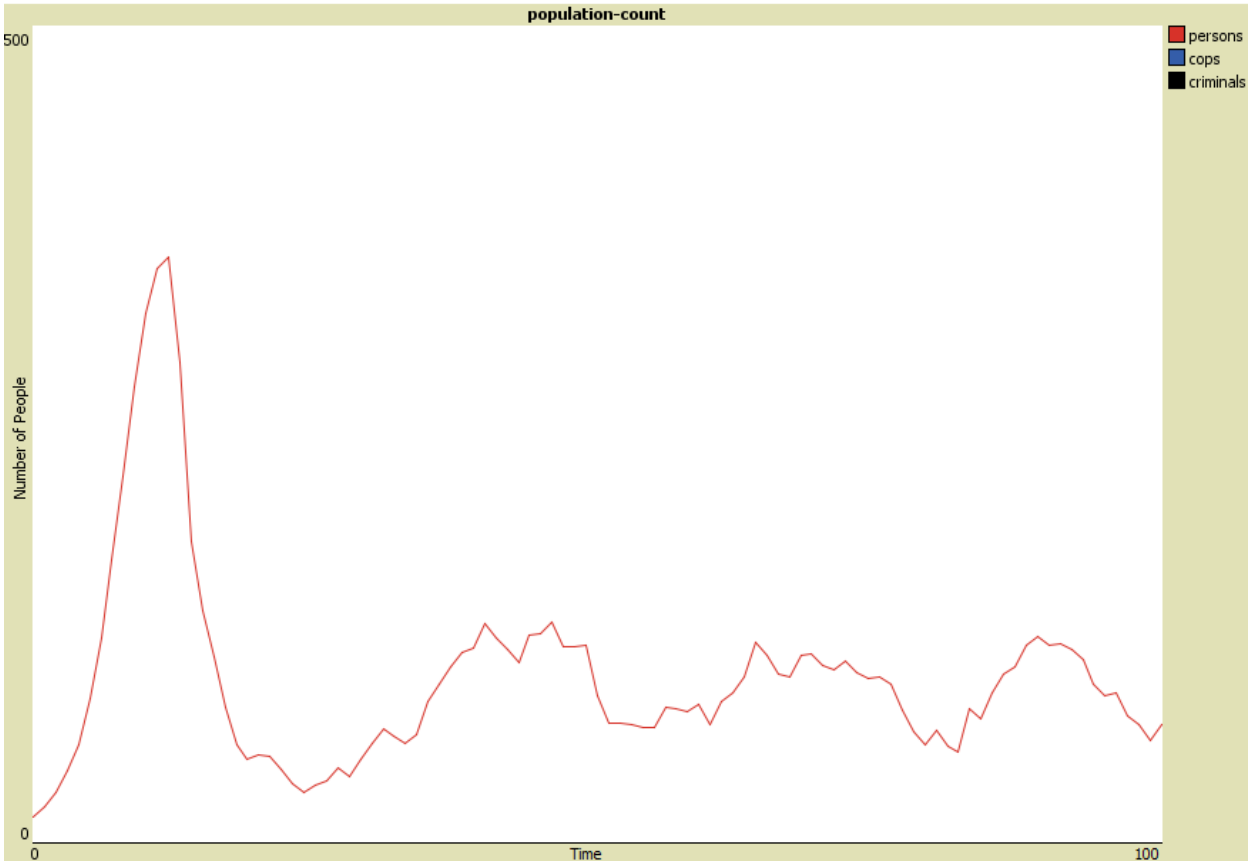
A particularly important variable is sanitation. We postulated that if the government contributed to the health of the society, the citizens would be healthier and therefore more able to reproduce. Additionally, if the community is cleaned on a regular basis, the health of the society would increase as well. By using the "chooser" feature on NetLogo, we can pinpoint specific descriptions and distinct conditions of these variables and fuse the significance of each factor into our code.

The availability of natural resources is also important. In addition to allowing countries to produce their own goods (and not requiring them to import, and possibly even allowing them to export their goods to other countries), natural resources boost the "energy" and the economy of each citizen and the country respectively.

Controlling our variables allows our society to have low crime rates, high reproduction rates, an expanding economy, a growing number of resources, and a fairly satisfactory government. We can also observe the dependency of variables upon each other as well. Through graph and data outputs, we are able to collect data that can be used to implement our model into the real world.

Results & Analysis

This first scenario is our control.

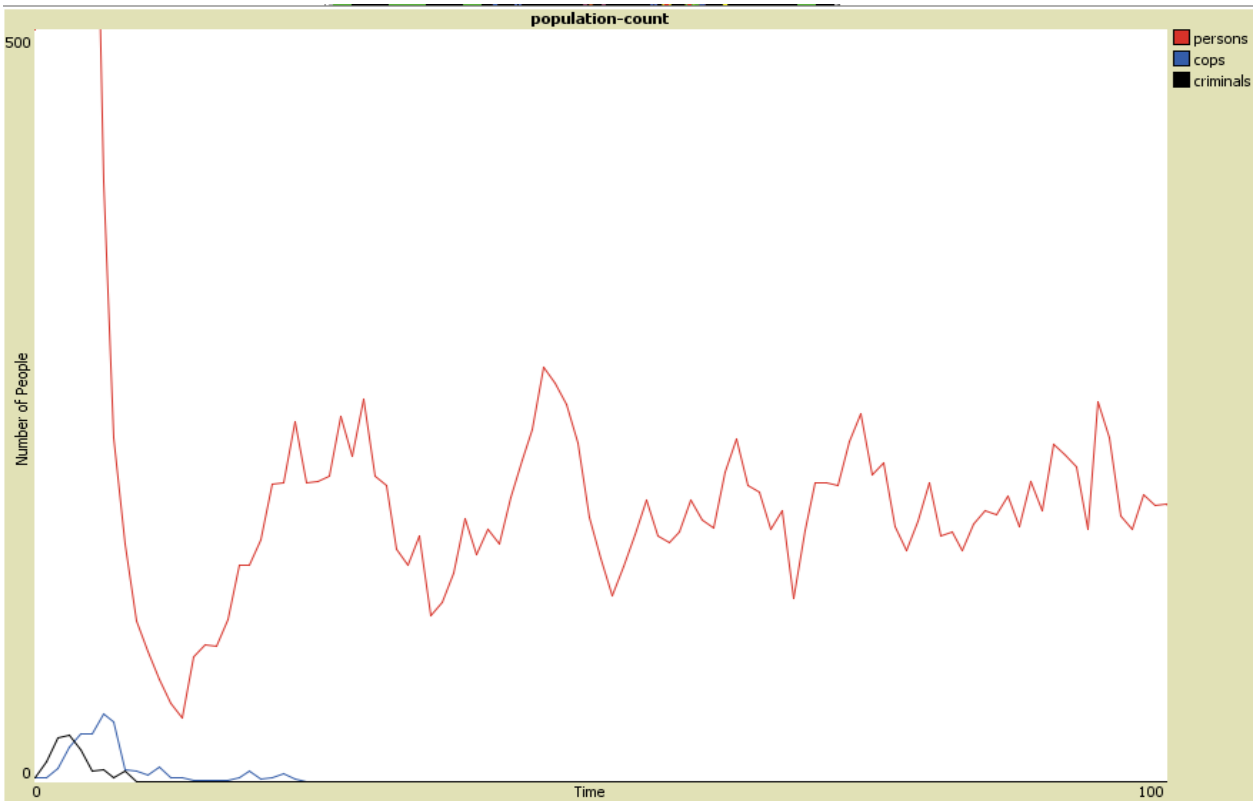


Note the logistic curve in the beginning. From this graph, we can conclude that our model for a classic and original ecosystem is accurate. No other variables have been activated to skew these results.

Set 1: The following are three different trials of the relationships between the citizens, cops, and criminals. We ran the program several times and extracted the most commonly appearing graphs for analyses.

Trial

1:

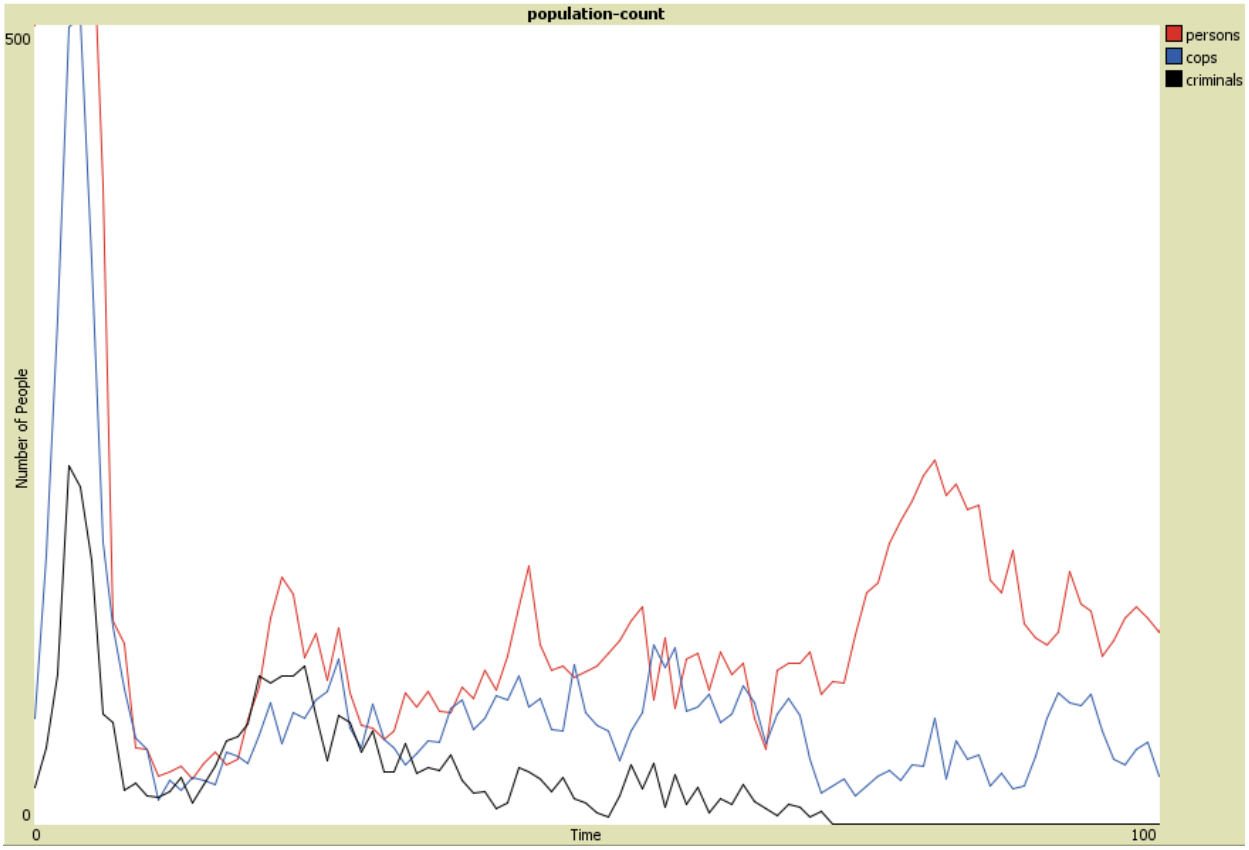


In this scenario, we started with 500 citizens, 3 cops, and 3 criminals. The graph shows an increase in population of citizens (as meals are initially abundant), and eventually the population of the cops and criminals reach 0. This is because after the criminals die, cops are no longer necessary to protect the citizens from outlaws. This is assuming, of course, that only

criminals can breed criminals.

Trial

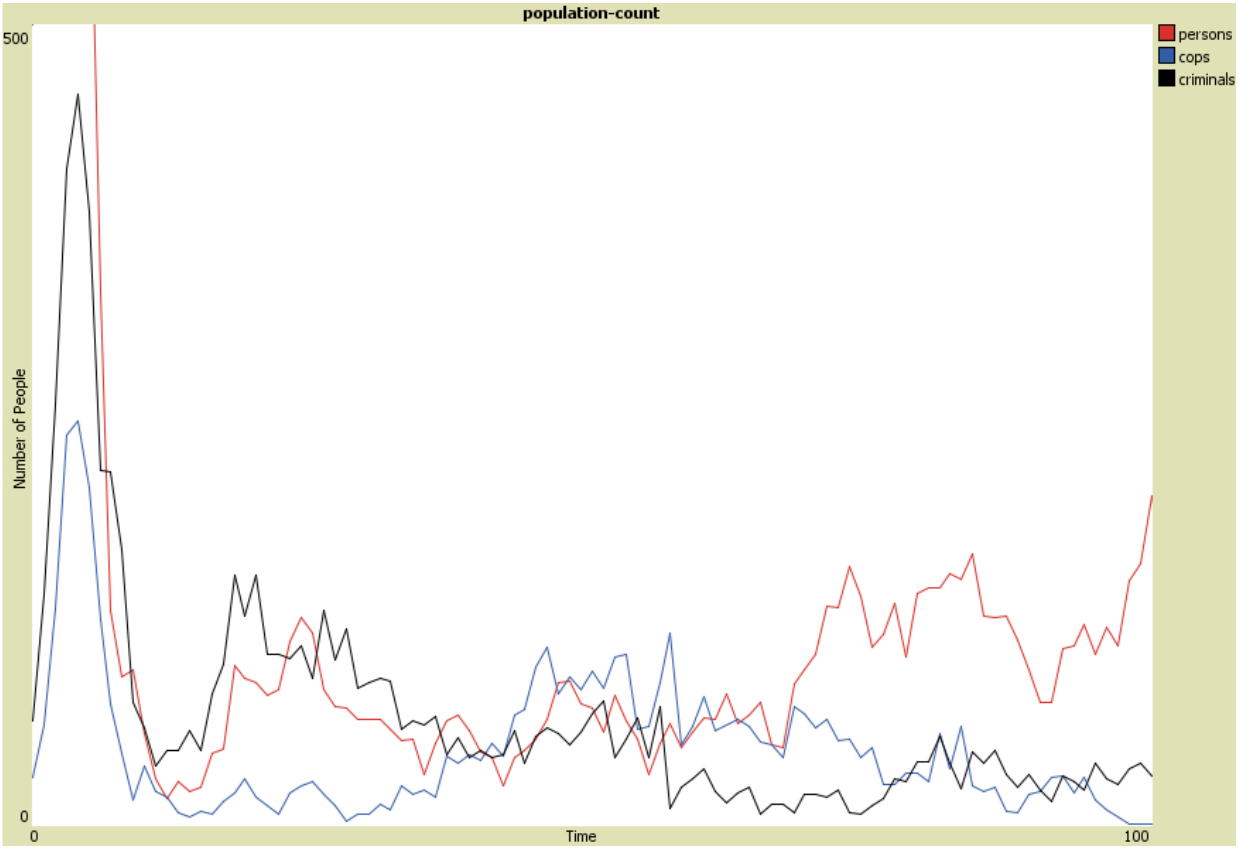
2:



With 500 citizens, 65 law officials, and 30 criminals, the number of criminals, once more, reaches 0. There is twice the number of law officials than criminals, so the results are self-evident. Eventually, as time goes on, the number of cops will also reach 0 as they will no longer be needed in the society.

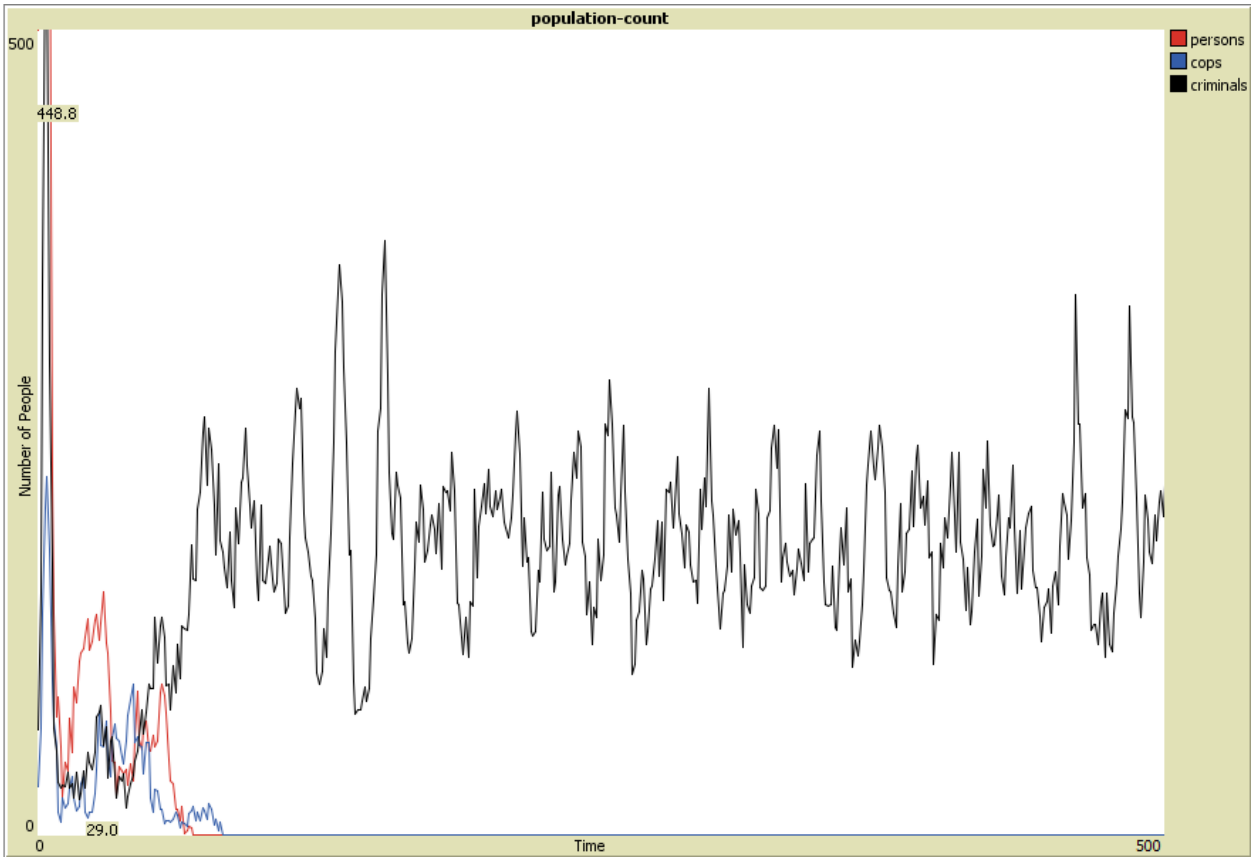
Trial

3.1:



In this scenario, the number of citizens is still 500, but the population of criminals is now 65 while the population of cops is now 30. After 100 units of time, the number of law officials reaches 0, but the criminal activity is still quite active.

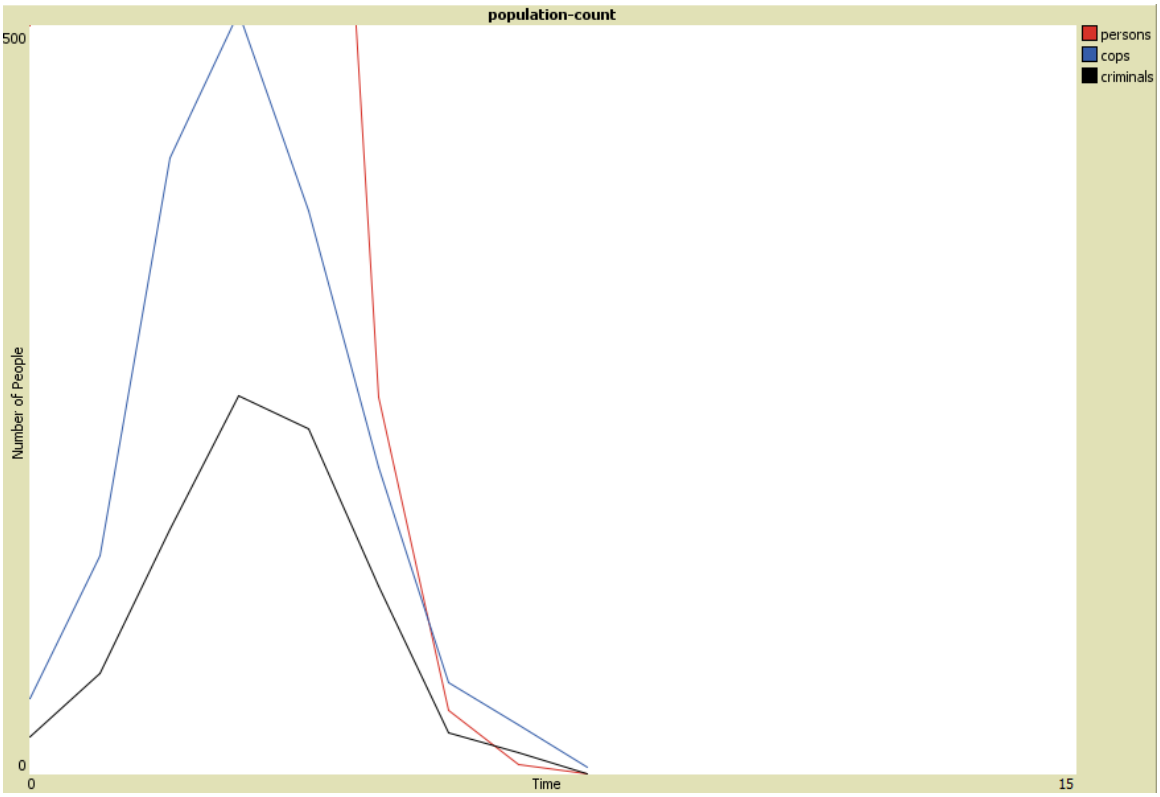
Trial 3.2



However, after extending this graph to a domain of 500 units and rerunning the NetLogo program, criminals eventually take over the society.

Set 2: These next few trials adjust the government health in funding and the sanitation of the community.

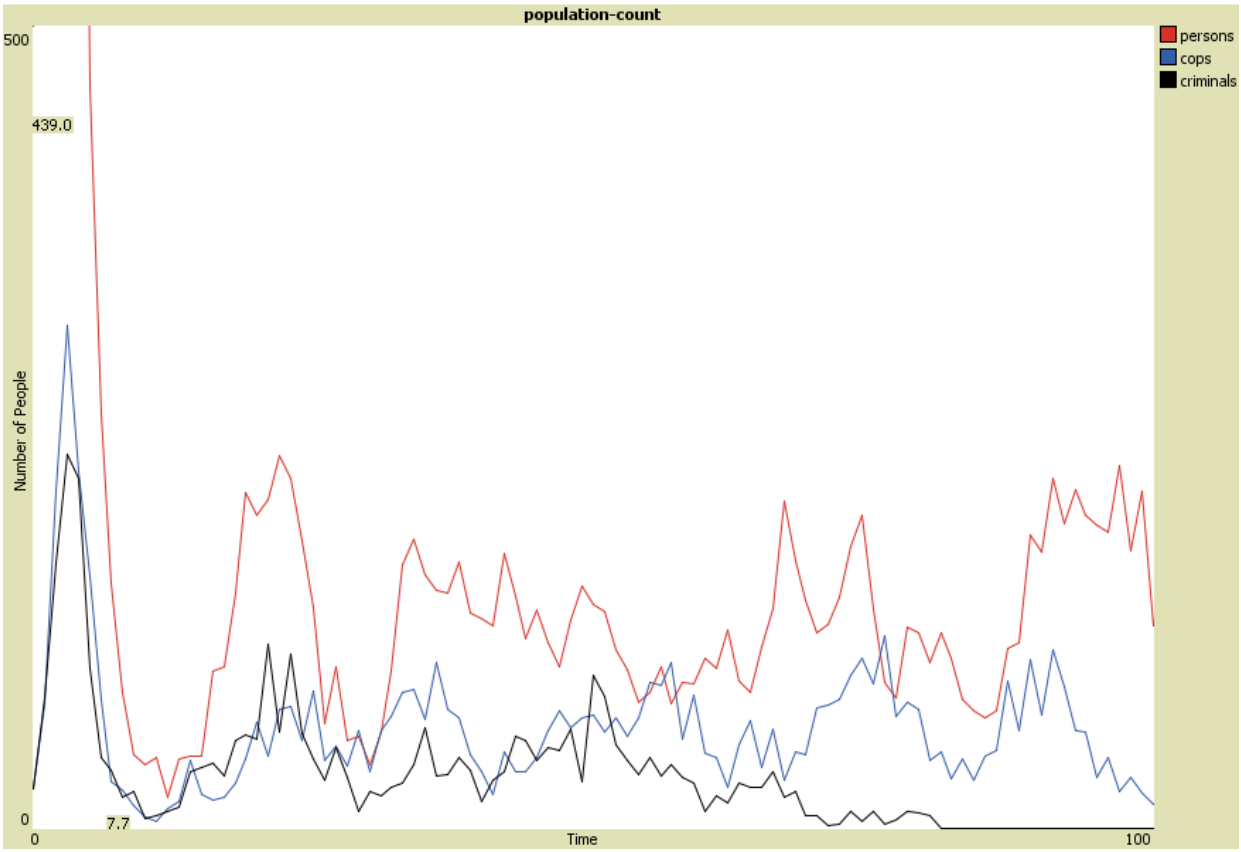
Trial 1:



This scenario runs without government funding in health and is completely unsanitary. Not even 100 units of time have passed, and the populations for citizens, cops, and criminals have all reached 0. Meals were probably unclean and carried diseases, immediately killing the population within less than 10 units of time. In addition, no natural resources (such as water, crops, timber, etc.) were available for necessary survival.

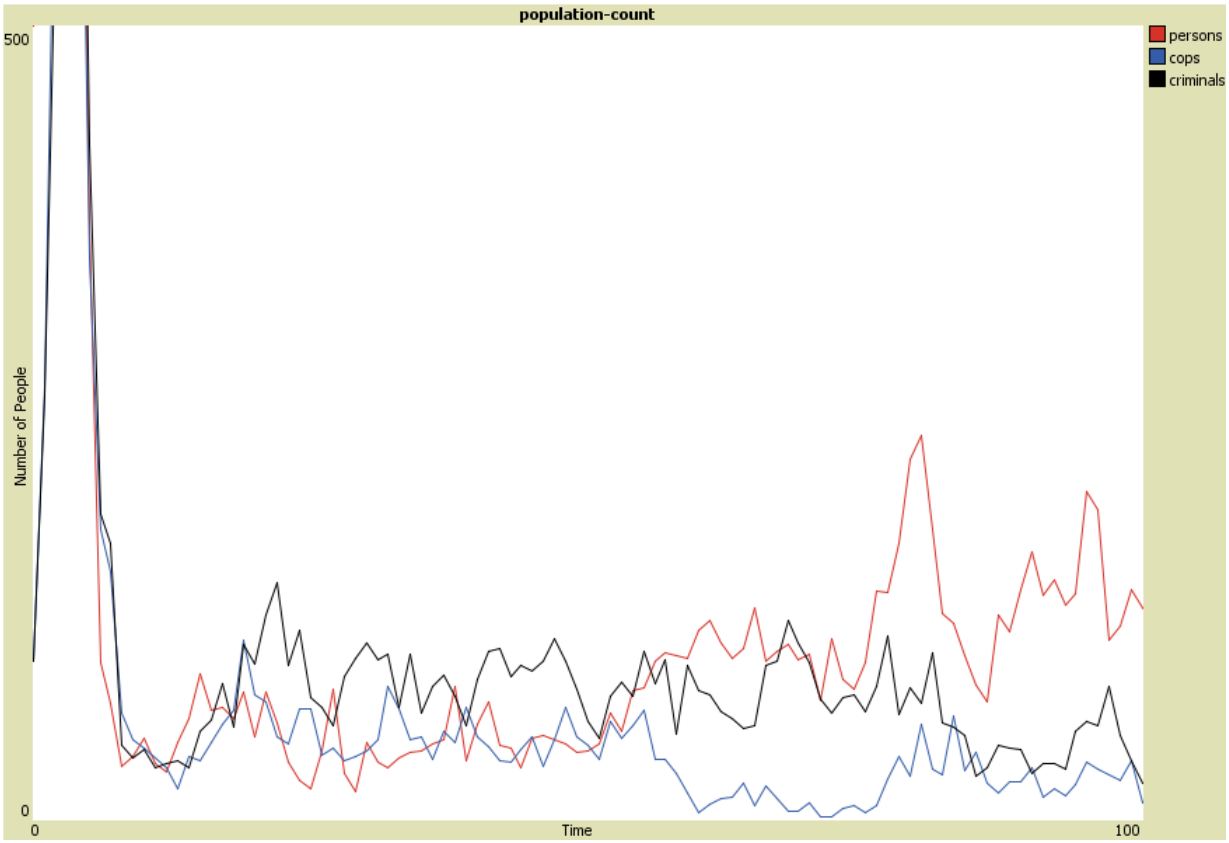
Trial

2:



This trial includes natural resources, but still does not offer government funding for health or sanitation systems. Evidently, the populations are still able to survive!

Trial 3:

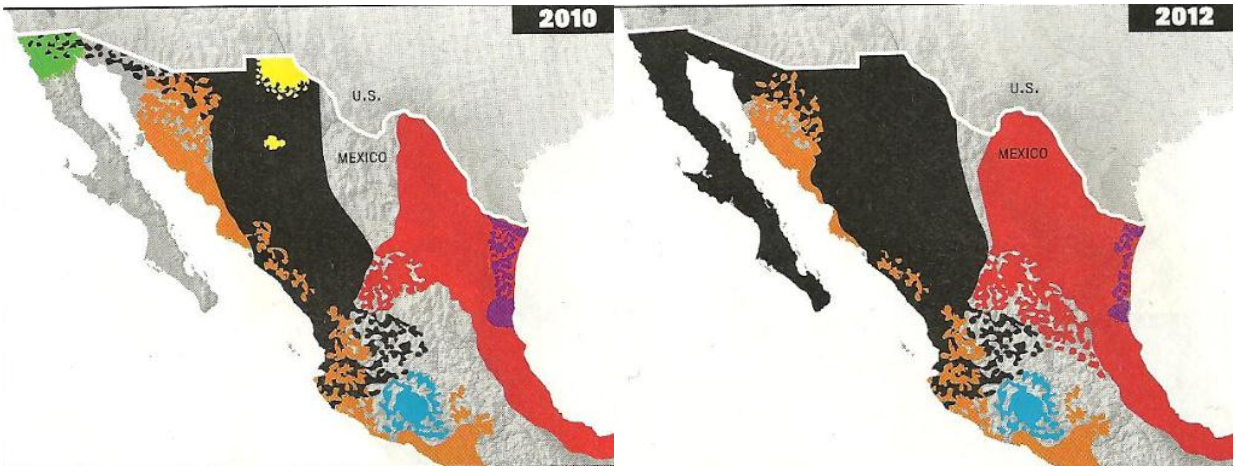


This trial was modeled off of the United States. The government health funding is available, and sanitation is "great." Towards the end of the graph, we can see that the citizens' population is fairly high and stable, and the crime rate and law enforcement relationship fluctuates rather normally.

Conclusions

In our model, we have concluded with reasonable results. Though we simplified our society into only a few variables, we succeeded in creating a model for a utopia.

The situation of Set 1 is similar to the situation in Mexico with the drug cartels. Though there is still law enforcement, the drug cartels have most of the power of Mexico's affairs. The two photos below from *Newsweek* depict the exponential power takeover of the Sinaloa cartel (black) reign from 2010 to 2012. Our results here portray the exact same model, and according to our results, if no changes are made to Mexico's societal systems (or possibly even the United States' systems), the Sinaloa will conquer all of Mexico, and a protective government would be nonexistent.



Set 2/Trial 1 depicts a society that cannot function. Not only is there a lack of governmental control, but there are also no resources or nutrients of which the inhabitants can thrive off of. There is no particular country with such a situation, so our results make sense

because no society would be able to function without these three key components.

Team Utopia was shocked by the results in Set 2/Trial 2, but we realized that the results actually make sense because, before civilization, humans were able to survive (though on a smaller and more sparse scale) without centralization and sanitation. A specific example is Native American civilizations, which were able to form small communities and live off their land's natural resources. Criminal activity was even quite low, which led us to the conclusion that in smaller societies, criminal activity will be less prominent.

We ran most of these trials several times, but we took the most reoccurring results from each trial to show in our results. Sometimes, by random "throwing of the die," the criminal activity would shoot up out of nowhere, from 3 to 200. Sometimes a feud would occur between cops and criminals, and the citizens eventually died out. However, we accepted these results as natural cycles of societies.

In conclusion, the development of a society is just as random as choosing stocks from the stock market. For instance, Mexico was not always dominated by drug lords. Australia's scarcity of resources has not stopped it from welcoming immigrants every year. The utopian society is not impossible, but it may not be quite possible, either. A perfect country will one day form from ashes, and theorists would still be unable to analyze which attributes contributed to its perfection. Maybe the utopia already exists—it really comes down to the big picture, and how the citizens in the little picture contribute to the society as a whole.

Achievements

The most valuable aspect Team Utopia has gained from the Supercomputing Challenge is learning how to work as a team. Through all the inflexible scheduling and the challenging method of communication, we have pulled through to the end.

We have, in short, created a simplified version of the perfect community, the perfect island, the famed utopia. With all our variables, we can control the government, the population, the sanitation, and natural resources of our community. However, we also realized that utopias formed are really randomized, and several factors may contribute to one attribute turning its back on its society. Random numbers deciding the death of one person in our model could determine the outcome of the entire society. That random death represents anything from natural disasters, incurable health issues, murders, or even a collapsing economy.

As we reminisce over our project, we have realized the importance to knowing how to work as a team. Delegation has also been extremely important, and our end results are extremely satisfactory.

On top of creating our model and learning how to work in teams, however, we have learned mountains of information about countries, poverty, economics, governments, nature, and international affairs.

Works Cited

CarbonPig. (n.d.). Retrieved from http://carbonpig.com/article/10-most-sustainable-countries-world.

Country Rankings. (2012). Retrieved from http://www.heritage.org/index/ranking.

Harvey, Fiona. (2011, Jun 27). Donor aversion to 'unsexy' water project threatens development goal. *The Guardian*. Retrieved from http://www.guardian.co.uk/global-development/poverty-matters/2011/jun/27/donor-aversion-water-projects.

"In a Perfect World." *Mibba*. Retrieved from http://articles.mibba.com/People/3539/In-a-Perfect-World-Utopia.

Karlin, Anatoly (2011, Jan 16). Top ten most powerful countries in 2011. *Sublime Oblivion*. Retrieved from http://www.sublimeoblivion.com/2011/01/16/top-10-powerful-countries-2011/

"Lonely Planet's Top 20 Countries for 2011." (2010, Oct 31). *The Lonely Planet*. Retrieved from http://www.lonelyplanet.com/albania/travel-tips-and-articles/76164.

Merchant, Brian. (2011, Jan 12). Would Guns Exist in a Perfect Society? *The Utopianist*. Retrieved from http://utopianist.com/2011/01/yes-guns-can-exist-in-utopia/.

Roman (2010 Nov 29). Top ten happiest countries in the world. *Financial Jesus*. Retrieved from http://www.financialjesus.com/how-to-get-rich/top-10-happiest-countries/.

"Total renewable water resources (most recent) by country." *NationMaster*. Retrieved from http://www.nationmaster.com/graph/env_tot_ren_wat_res-environment-total-renewable-water-resources.

24/7 Wall Street. (2011, April 22). Top ten most – and least – green U.S. states. *Daily Finance*. Retrieved from http://www.dailyfinance.com/2011/04/22/top-earth-day-10-most-and-least-green-u-s-states/.

Underdog. (2006, May 19). What makes utopia? [Web log]. Retrieved from http://chingsutopia.blogspot.com/2006/05/what-makes-utopia.html.

"Utopia." *British Library*. Retrieved from http://www.bl.uk/learning/histcitizen/21cc/utopia/utopia.html.

"Water consumed this year." *Worldometers: real time world statistics*. Retrieved from http://www.worldometers.info/water/.

Will, Jon. (n.d.). Utopian Philosophy. Retrieved from http://users.erols.com/jonwill/.

Yamashita, Michael S. (2010, Aug16). *Newsweek*. Retrieved from http://www.thedailybeast.com/topics/the-world-s-best-countries.html.

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Net Logo Code

```
;;Team Utopia (58) 2011-2012 Super Computing Challenge
;;Coding Manager Samantha McGuinn
;;Special thanks to the Young Women in Computing program at New Mexico State University
breed [cops cop] ;; sets some turtles to be cops
breed [persons person] ;; sets some turtles to be people
breed [criminals criminal]
turtles-own [energy]    ;; both persons, cops, and criminals have energy
criminals-own [];; criminals can be targets
cops-own []

;;WORLD METHODS

to setup
 clear-all ;; clear world
 setup-persons ;; set up the turtles in the world
 setup-cops ;;set up the cops in the world
 setup-patches ;; set the background up
 setup-criminals ;; set up the criminals in the world
end

to go ;; all of the methods that occur when you press "go"
 if not any? turtles [ stop ]
 move-turtles
 eat-grass
 farm-food
 update-plot
 reproduce-persons
 reproduce-cops
 reproduce-criminals
 ask cops [ catch-criminals ]
 ask criminals [ commit-crime ]
 ask turtles [ death ]
end

;;SETUP METHODS

to setup-persons ;; set up turtles in the world
 create-persons Population ;; create the number of turtles specified in the population box
 ask persons [ setxy random-xcor random-ycor] ;; turtles will be randomly placed in the window
 ask persons [ set energy random (2 * energy-gain-from-food)]
 set-default-shape persons "person" ;; people are shaped like people
end
to setup-cops
 create-cops law-officials ;; create the number cops specified in the law-officials input box
```

```
 ask cops [ setxy random-xcor random-ycor] ;; turtles will be randomly placed in the window
 ask cops [ set energy random (5 * energy-gain-from-food)]
 set-default-shape cops "police" ;; set the cops to be shaped like police

end
to setup-criminals ;; set up turtles in the world
 create-criminals criminal-population  ;; create the number of turtles specified in the criminal
population
 ask criminals [ setxy random-xcor random-ycor] ;; turtles will be randomly placed in the
window
 ask criminals [ set energy random (5 * energy-gain-from-food)]
 set-default-shape criminals "criminal" ;; criminals are shaped like criminals
end
to setup-patches
 ask patches [ set pcolor green]
end

;;LIFE METHODS

to move-turtles
 ask turtles
 [ fd 1 ;; all turtle move forward 1 steps
          rt random 10 ;; and turn right a random amount
          lt random 10 ;; and turn left a random amount
          set energy (energy - 1)] ;; people loose energy as they move
end

to eat-grass
 ask turtles [ ;; when a turtle encounters a patch:
          if pcolor = green [ ;; if patch color is green
          set pcolor black ;; turn the patch black
          set energy (energy + 3) ;; people gain energy when they eat food
          ]
 ]
end
to death  ;; turtle procedure
 ;; when energy dips below zero, die
 if energy < 0 [ die ]
end
;;REPRODUCTION METHODS

to reproduce-persons  ;; create more people as time goes by
 ask persons [
 if random-float 100 < person-reproduce [  ;; throw "dice" to see if you will reproduce
          set energy (energy / 2)           ;; divide energy between parent and offspring
          hatch 1 [ rt random-float 360 fd 1 ]  ;; hatch an offspring and move it forward 1 step
```

```
 ]
 ]
end
to reproduce-cops  ;; cops breed more cops
 ask cops [
 if random-float 100 < cop-reproduce [  ;; throw "dice" to see if you will reproduce
          set energy (energy / 2)           ;; divide energy between parent and offspring
          hatch 1 [ rt random-float 360 fd 1 ]  ;; hatch an offspring and move it forward 1 step
 ]
 ]
end
to reproduce-criminals  ;; criminals create more criminals together
 ask criminals [
 if random-float 100 < criminal-reproduce [  ;; throw "dice" to see if you will reproduce
          set energy (energy / 2)           ;; divide energy between parent and offspring
          hatch 1 [ rt random-float 360 fd 1 ]  ;; hatch an offspring and move it forward 1 step
 ]
 ]
end

;;NON-TURTLE METHODS

to regrow-grass  ;; turn black patches back to green
 ask patches [
          if random 100 < 5 [set pcolor green]
 ]
end
to farm-food  ;; if the farming switch is on, regrow grass, A.K.A. meals
 If natural-resources [
          regrow-grass
 ]
end

to health-care ;;if the government funded health switch
 if gov-fund-health = "none" [
          set energy (energy - 2)]
 if gov-fund-health = "poor" [
          set energy (energy - 1)]
 if gov-fund-health = "moderate" [
          set energy (energy + 1)]
 if gov-fund-health = "good" [
          set energy (energy + 2)]
end
to sanitation-level ;;if the government funded health switch
 if sanitation = "poor" [
          set energy (energy - 1)]
```

```
 if sanitation = "moderate" [
          set energy (energy + 1)]
 if sanitation = "good" [
          set energy (energy + 2)]
 if sanitation = "great" [
          set energy (energy + 3)]
end

;;PLOT OUTPUT

to update-plot
 set-current-plot "population-count"
 set-current-plot-pen "persons"
 plot count persons
 set-current-plot-pen "cops"
 plot count cops
 set-current-plot-pen "criminals"
 plot count criminals
end

;;Criminal/Cop Connection

to catch-criminals  ;; cop procedure
 let prey one-of criminals-here ;; grab a random criminal
 if prey != nobody ;; did we get one?  if so,
          [ ask prey [ die ] ;; kill it
          set energy (energy + 1) ] ;; get energy from catching
end
to commit-crime ;;criminal procedure
  let prey one-of persons-here ;; grab a random criminal
 if prey != nobody ;; did we get one?  if so,
          [ ask prey [ die ] ;; kill it
          set energy (energy + 1) ] ;; get energy from catching
end
```