Project Alienation

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Abstract

The intent of this paper is to analyze the militaristic potential and creative mapping potential within Geographic Information Systems (GIS) for both liberation and defense purposes through a project, Project Alienation (PA), displaying the hypothetical invasion of an alien ground force defined by the literary classic *War of the Worlds* written by H.G. Wells (Wells, 1960). PA focuses lightly on location analysis but is primarily based on cost distance analysis and analysis based on the results of that cost distance. The results show the impact of the theoretical invasion but also show the advantageous side of GIS in military strategy planning while also revealing its shortcomings while hitting on the limitations of creative mapping in GIS.

Introduction

The intent of this paper is to analyze the militaristic potential within Geographic Information Systems (GIS) for both liberation and defense purposes through a project, Project Alienation (PA), displaying the hypothetical invasion of an alien ground force defined by the literary classic *War of the Worlds* written by H.G. Wells. Coming from an AutoCAD, 3D rendering and artistic background, I had hoped to utilize GIS in a way that was something creative and different, while still reaching out to an academic audience. With that, Project Alienation was born and implemented into the first of its kind.

Theoretical Foundation - *Theory of Invasion*

In theory, if an alien invasion of the caliber read about in *War of the Worlds* were to take place in reality, not only would we likely have no real chance to be saved by some last ditch effort by our Tom Cruise American action hero, there would also honestly be no real need for a geospatial analysis to be done. E.T. shows up with a bad attitude, zaps us, game over. However, while a real alien invasion army may have no legitimate limits, human forces absolutely do have limitations, objectives and desired outcomes that must be planned for accordingly.

In modern times, often the talk of military limitations in the public is strictly that of political nature. Newsweek's cover story in 1990 was of *Invasion*, an article that focuses much more guerilla warfare and the political limitations in war (D.Contreras, 1990). Though this article is relatively old, it just about sums up the discussion of strategic military decisions of the last few decades that miss the true, mostly, measurable elements of military campaigns and what makes them successful. Geography, strategic points of interest, soldier transportation, environmental

concerns and many other costs go through the minds of generals planning out either a military advancement or defensive set up that are crucial to coming out victorious.

Military Geography: The Influence of Terrain in the Outcome of the Gallipoli Campaign, 1915 is an article from "The Geographical Journal" that explains just that, the terrain tactics of the Gallipoli Campaign of 1915 (Doyle, et al. 1999). In this campaign, the authors exhibited how the movement of troops and supplies was very essential to an effective battle strategy. The best strategies involved control waterways to slow down and the limit the movement of both enemy troops and supplies while taking advantage of those waterways for one's own use (Doyle, et al. 1999). These types of ideas are common in military planning as many recognize familiar strategies that liken themselves to that of the Vietnam War or even the first and second World Wars.

While these ideas may seem more modern as they have repeated themselves in the last century, they are in fact a proven commonplace in military planning that has been seen for many centuries. Georgios Theotokis writes about the Norman Invasion of Sicily in 1061 AD in the "War in History" journal that shows many of these same strategies took place nearly 1000 years ago (Theotokis, 2010). Theotokis describes the problems ground troops and animal mounts would run into in terms of terrain and how they would have to plan ahead to tactically avoid problems or use those problems to their military's advantage.

These examples show that battle strategies have always relied on geospatial information, but have always been accomplished without the use of geospatial technologies as they were not available. In today's world, GIS is not only more available than it has been but it should be theoretically up to the task of preforming such analyses that can plan out military invasions of

one's own or opponent's army. Ultimately it leads to a question, the question of this paper, not can an invasion strategy be determined via GIS in a realistic manner, but also, should it be determined by a GIS analysis? This idea, this theory, of invasion strategies being determined via GIS is really the core issue of PA, however, the process of testing this theory brought up another issue that targets today's push for participatory GIS.

Planning Process - *Creative Mapping*

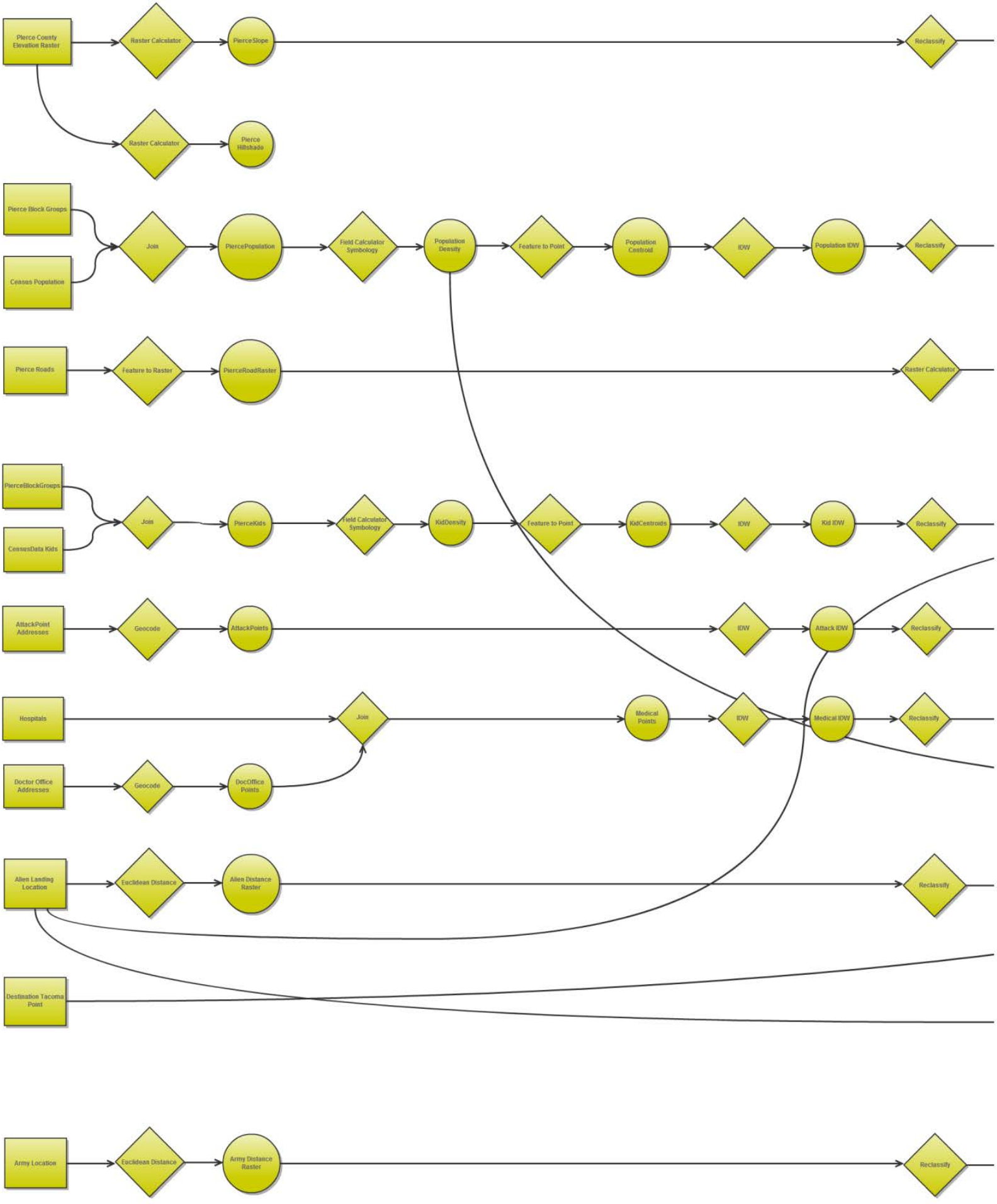
That issue is what I call creative mapping. In a project such as this, participatory GIS could be very effective and is truly necessary for an accurate analysis of invasion strategy. However, for a project such as this, it is much harder to gain access to the participants needed; military generals, soldiers and other service men/women with invasion planning experience. This lack of access, along with an out of the box idea for a project, lead me to use creative mapping. Creative mapping, as I am defining it, is taking fictional sources or authors and using their story teller's point of view as either additional data. This is very much similar to participatory GIS techniques that involve georeferencing historic maps, records and journals. The difference here being that in creative mapping one would be using fictional sources that while they may be based on reality or have real implications, their nature is in fact fictional.

While it may sound un-affective and non-sensible, it can very much serve a purpose for GIS projects that want to argue important points that have been articulated through fictional storytelling. This brings us to the start of Project Alienation and how it was founded. It began as simply something fun to do with no real intent other than to display an alien invasion in Pierce County to be a creative example of what can be done in a GIS. At the start I was almost

immediately stumped; who are my aliens, where are the landing, why are the landing and many other questions sprung up that define who they are.

Fortunately, science fiction movies have already been thinking the same things for years and my research was jump started with Stephen Spielberg's *E.T., the Extra-Terrestrial* (E.T., the Extra Terrestrial, 1982). Immediately ideas began to come up that could be used for an E.T. invasion. Soon it became that my aliens were coming as revenge upon E.T.'s past abduction by the government, the E.T.s were to use their bond with kids to infiltrate military structures and capture dairy farms for Reese's Pieces production. Unfortunately, while planning this, things began to be too broad and relatively meaningless. While Spielberg defined some of who E.T. was, the story was primarily focused on the connection between the boy and E.T. and less on E.T.s purpose for having landed there to begin with (E.T., the Extra-Terrestrial, 1982). This sent PA back to square one and I began looking for new aliens that were well known but had more purpose to their madness. Predator came up, as did Alien, but they still did not really fit the role I was looking for, they simply came to just fight either themselves or us with no real backstory (AVP: Alien vs. Predator, 2004).

I was then reminded by a fellow student of the H.G. Wells' classic *War of the Worlds* and the tripod invasion. Upon picking up the book and watching the film, I realized that Wells had given me exactly what I needed. The aliens were fairly defined on they were but more importantly they were defined and why they were here. They had intent of enslavement, and wanted to start their first phase by taking out key structures that would basically put the human race out of commission so they could began their invasion (Wells, 1960). My plan became guided by the plotline of *War of the Worlds* (the book) only instead of a pastime London it is a modern day Pierce County, WA.


Pierce County Elevation Raster
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Doctor Office Addresses
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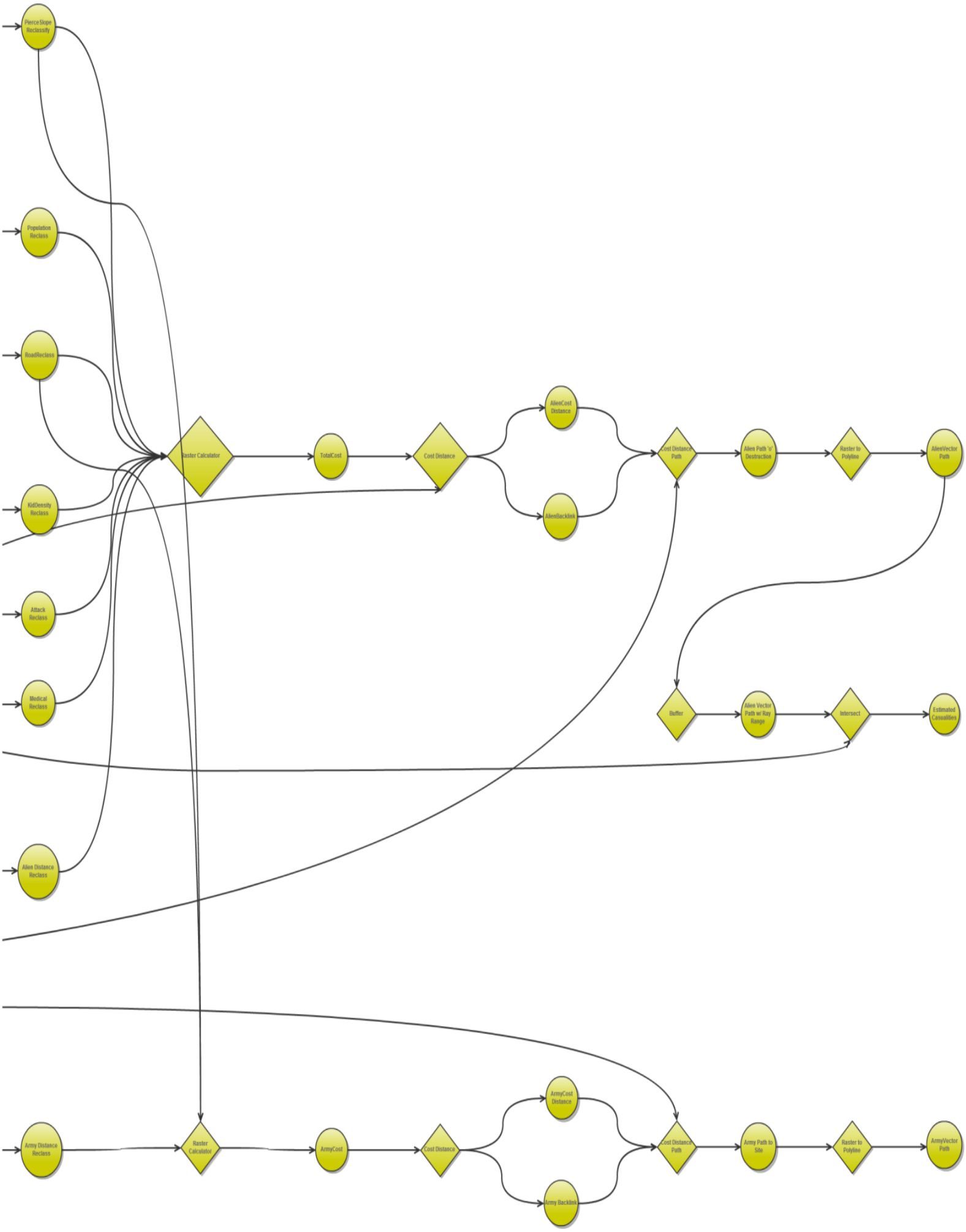
Pierce Slope Reclassify
Population Reclass
RoadReclass
KidDensity Reclass
Attack Reclass
Medical Reclass
Alien Distance Reclass
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AlienBacklink
Cost Distance Path
Alien Path 'o' Destruction
Raster to Polyline
AlienVector Path
Buffer
Alien Vector Path w/ Ray Range
Intersect
Estimated Casualties
Army Distance Reclass
Raster Calculator
ArmyCost
Cost Distance
ArmyCost Distance
Army Backlink
Cost Distance Path
Army Path to Site
Raster to Polyline
ArmyVector Path

Above, Figures A and B are respectively the beginning and end of a workflow I made in the beginning to represent the processes to be done in ArcGIS. Before moving on to the methodology it is important to note that this workflow was the PA's original intended process, but ultimately many things were changed as some methods failed while others worked in different ways than planned, but with that in mind, it is still a very effective reference point.

Also, it is good to note why the data above were selected to carry out H.G. Wells' *War of the Worlds*. The distance, slope, medical points and kid density layers are the determined negatives, things to avoid, for the tripod force. The slope and distance are tied to the actual mechanics of the tripods, in the same way Theotokis talks about troop movement, the slopes and distance are not just more difficult on ground troops but also can be impassable, specifically the slope of the terrain (Theotokis, 2010). The medical points and kid density layers were determined as things to avoid because Wells' tripod aliens ended up dying not because of our military's response, but because of their susceptibility to our diseases. Because of this, the aliens would want to avoid hospitals/doctors' offices that hold disease and also avoid dense areas of you children who are more frequently ill (Wells, 1960). The attack-points layer, however, were locations that the tripods want to get to as the points are targets they needed to destroy as they did in the book (Wells, 1960). The roads layer was put in place to give them a track that would help the aliens not only have a well-defined path to where they need to go, but also to help them avoid traveling through bodies of water, marshes and large crevices that would do harm to their tripod machinery. The population density was to get the aliens to attack large groups of people but was ultimately removed along with the military cost path which was also removed which will be explained in the next section, methodologies.

Methodology

In a GIS, especially ArcGIS, there are always many ways to do the same or similar analysis and the methods heavily depend on the data involved and the outcome desired. For PA, the invasion was to be determined via the cost distance and cost path tools. The cost path tool operates a least cost path analysis which determines a path from the user's start point to the user's destination point(s) in a manner that is the least costly for the object to travel that path, in this case, the alien tripods. The way this process works is the user must establish different costs that are then calculated into a total cost which is converted via cost distance into what is called a cost grid. This cost grid is based on the cost path's starting point and determines for every cell, the cost it would take for that path to cross each cell.

Figure A displays the first part of this process, determining the costs for the final path. I will use the medical points layer as the example of how the costs were determined. Firstly, the medical points layer would be added to the map(.mxd) and would have the IDW tool operate on the points. The IDW tool has the purpose of showing the density of points in an area and then displaying that in a categorical raster. Once this is done, the raster then must be reclassified. The reason every cost needs to be reclassified is because each cost needs to a similar cost system. When every cost is reclassified they are then totaled up into the total cost raster which weights different costs to different levels as determined by the user. If each layer has a different cost system, they will be inappropriately weighted and lead to a poor analysis (see Figure C). To avoid this, a similar enough cost system needs to be decided in advance and have all costs be reclassified as best as they can be to that cost system.

For PA, the cost system was set at fifteen costs. What this means is each cost layer would be reclassified into fifteen different classes, the first class being the lowest most desirable class and

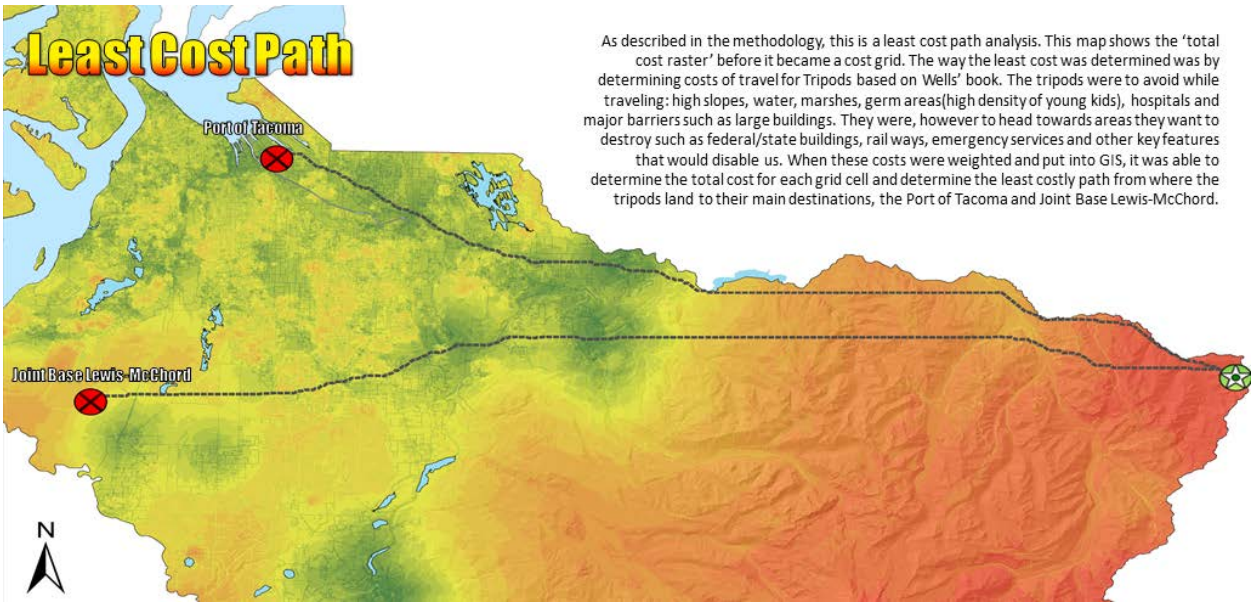
the fifteenth class being the most expensive unwanted class. Coming back to our example of the medical points, they would be reclassified to show the density at classes of fifteen. Once this was done for every cost, the user would put the cost rasters into the raster calculator tool to determine the total cost while applying weights to each cost. By adding weights, the user can determine if some costs are more important. So in the case of PA, the kid density layer was so crucial to avoid that it was given a weight that made it a bigger chunk of the total cost as a whole. Once the total cost raster is made it can then be put into the cost distance tool which will produce a cost grid and backlink raster. The backlink raster is just a raster that layouts out the eight directions the path can travel in raster cells. These two rasters can then be placed in the cost path tool which determines the least cost path.

While this was the main process, or at least the main planned process, there was also location analysis and casualty determination analysis done along with major changes to determining the cost rasters which will now be cover in the actual implementation of all the planned methods. Below, the implementation section will provide examples of maps that show the processes done.

Implementation

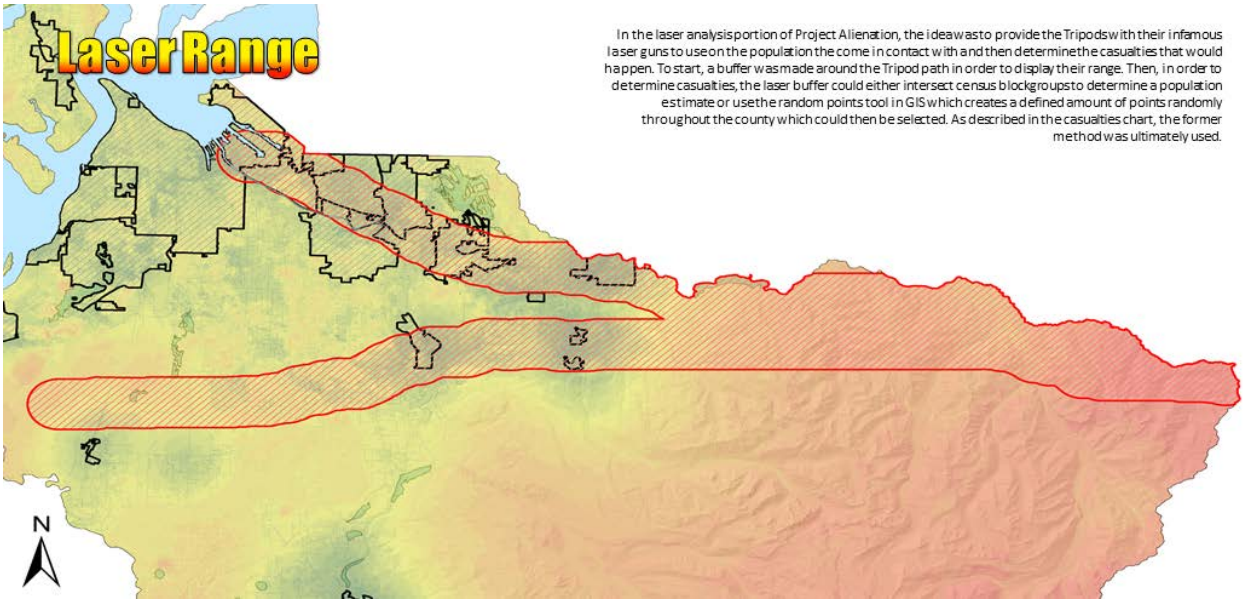
As described in the methodology, this is a least cost path analysis. This map shows the ‘total cost raster’ before it became a cost grid. The way the least cost was determined was by determining costs of travel for Tripods based on Wells’ book. The tripods were to avoid while traveling: high slopes, water, marshes, germ areas(high density of young kids), hospitals and major barriers such as large buildings. They were, however to head towards areas they want to destroy such as federal/state buildings, rail ways, emergency services and other key features that would disable us. When these costs were weighted and put into GIS, it was able to determine the total cost for

each grid cell and determine the least costly path from where the tripods land to their main destinations, the Port of Tacoma and Joint Base Lewis-McChord. The location analysis was done by finding the most realistic landing spot in a low cast area while avoiding high costs before the costs were turned into a raster grid. Also, departing from the original workflow, the IDW process was not actually used for all of the costs as planned, but only for the kid density. Euclidean distance was used on attack points to encourage the tripod invaders to close in, and used on hospitals which then was reclassified to keep the tripods away from the hospitals. The reason for this change was that in the extent of PA, there were not enough points in each cost category for the IDW process to make sense as it works off of density of large amounts of points.

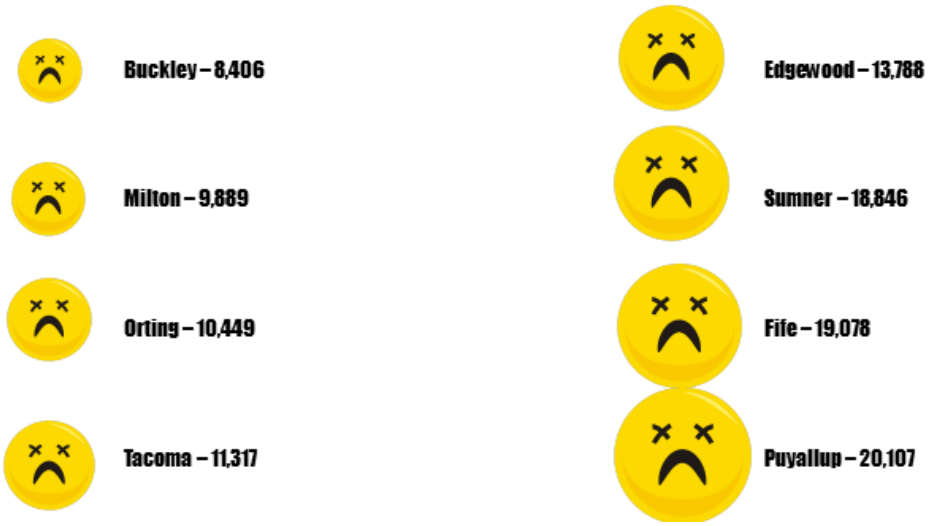


In the laser analysis portion of Project Alienation, the idea was to provide the Tripods with their infamous laser guns to use on the population the come in contact with and then determine the casualties that would happen. To start, a buffer was made around the Tripod path in order to display their range. Then, in order to determine casualties, the laser buffer could either intersect census blockgroups to determine a population estimate or use the random points tool in GIS

which creates a defined amount of points randomly throughout the county which could then be selected. As described in the casualties chart, the former method was ultimately used.



These are the estimated casualties of the most notable cities hit. The larger the symbol the higher the casualties in that area. While Bonney Lake, Puyallup and Sumner had the highest casualty count, small towns like Buckley and Carbonado were completely wiped out, whereas other cities like Tacoma only took minor hits. The way these can be calculated is by intersecting the laser buffer with county blockgroups and then doing simple math to determine the percentage of that blockgroup that was killed. The other method of doing this, random point generation, was in some ways an easier method, but demanded more from the map. It was essentially taking a map already loaded with a lot of data, and then adding one million points, which really slowed and crowded things up. The end total of casualties, just in the most notable cities was about 200,000 which is a big piece of Pierce County's 795,000 people. The points that the tripods are interested in taking may avoid some densely populated areas to avoid sick children, but they still hit major urban areas that take out a lot of people.



Results/Analysis

As far as results go, Project Alienation has ended with two major answers to the questions it sought out to answer from the beginning. In terms of replicating Wells' Tripod invasion in Pierce County, the results are fairly straight forward as shown in the Total Cost, Laser and Casualty maps. The aliens, following H.G. Wells' limitations for the Tripod war machines, are to stay close to the outer rim of cities while doing very limited travel within them. The reason being is that their targets of interest that they have come to take out are very urban in nature which pulls them towards downtowns, while the high density of young children who are typically sick push them to the edges of cities as they avoid their weakness of disease.

In terms of the second research question relating to military planning for invasion strategy, the results are not as straight forward. Pertaining to the question of can the military use GIS for invasion planning via cost distance and the other analyses done, the answer is most definitely yes. There are many aspects that would work well for the military, especially in location analyses and finding efficient routes. However, should they use GIS, not as a primary method but as a supplement to their planning. While cost distance analysis works for straight forward research

such as bike routes or Tripods, a military operation has too many alternating costs and is not a formulaic procedure. The costs a military operation would come up with would alternate too much for GIS to understand. Example being a slope cost. At some points troops would want to avoid slope for travel, whereas later on they may need slope for either high ground or to stay hidden. GIS does not handle these kind of changes well and requires a person to really determine these outcomes.

Conclusion

To conclude, Project Alienation was a fun project that was still able to reach to a realistic research questions. PA demonstrates that GIS can be used for more out of the box projects that can be based upon more creative data points. However, with saying that, GIS is still lacking in flexibility within its toolsets. The user can be incredibly limited in how open they want their analyses to be and PA very much exploits that. In the end, whether it be beyond the stars or in our back yards, GIS is a land of opportunities waiting to be invaded.

Citations

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