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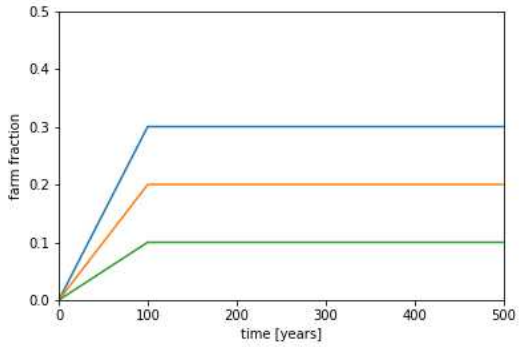
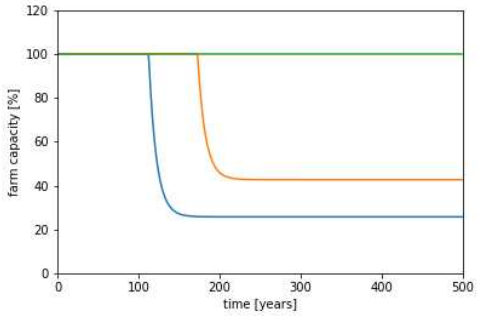
Physics 203 Report

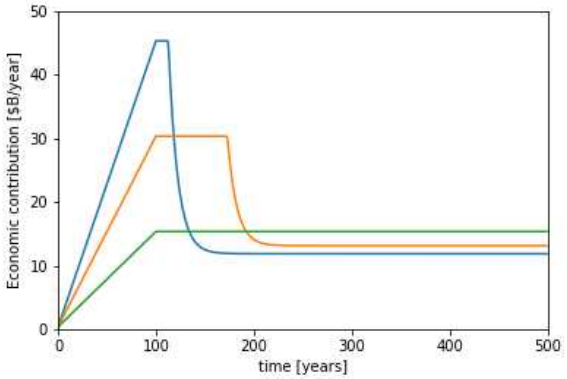
1. The main question that is being addressed under the extensive curtain of forest management is the idea of balance between the amount of farming acceptable on a certain land whilst maintaining the ecosystem and land sustainable. The question would be whether there is a limit to how much deforestation should be allowable in a certain land and turned into a farm. We are looking at the deforestation of the Amazon rainforest and looking at what amount of deforestation is the environment not sustainable. This is a present issue in Brazil because they are deforesting lands to be replaced by farms. Farms are great at helping the economy and provide food for people, but there is also runoff associated with farms in which water is basically wasted and is not going back into the land. This is in effect, helping grow the economy and helping provide resources to their people. However, there is a possibility of deforesting these areas and drying up the aquifer. If the aquifer were to dry up, this would have a huge impact on everyone in Brazil and would ultimately cascade to the rest of the world.
2. The main control in this model would be to place a limit on how much of the land should be allowed to be deforested. With more models, one can go about identifying how much of the land can be deforested and turned into farms that would both grow the economy and not harm water resources and the ecosystem in the Amazon. One way to go about doing this would be to create/modify existing policies that would limit deforestation in the land. There should be set parameters in how much of the land(acreage) should be allowed to be converted into farms and how much should be left alone to maintain the water levels in the aquifer and keep the ecosystem stable. In conclusion, the main control parameter should be setting limits to deforest able lands.
3. One of the main variables in the system is farm fraction with respect to time. This relationship gives rise to three other important relationships. As the fraction of farms in the Amazon goes up to different amounts (30,20,10%) things like the farm capacity, economy, and aquifer volume also change with respect to time. So, as the fraction of farms in Brazil is increased, the farm capacity (the efficiency of the farm) will be fine for a certain amount of time but eventually decline. Also, the economy will rise very fast for high farm percentages, but then as over foresting starts to take its toll, a drastic decline will occur. One more variable, aquifer volume, will go down to a point with time as more farms are utilized in the land.
4. A brief description of the meaning of each figure. It should be noted that the numbers presented are not actual figures, just merely guesses to be able to create a model.



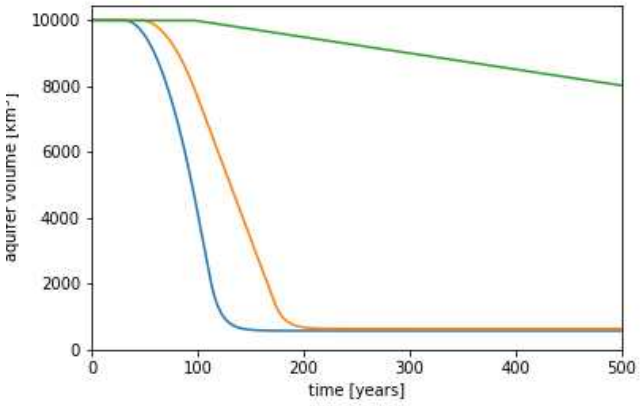
This first model basically places the parameters on what is being tested. This sets three different values for land being farmed. We tested values at 10% of farms, 20% of farms, and 30% of farms, meaning that these percentages of land in the Amazon would be deforested and replaced by farms. The 30% farm fraction is represented by the blue line in all the graphs to follow. This is also the case for the orange lines representing 20% and the green line representing 10%. Each of these values will be tested with a few different variables.



This second model establishes a relationship between farm capacity as it relates to time. The blue line representing 30% farms, shows an initial steady, 100% farm capacity for about 100 years, but then drops exponentially to about 25% for the next 400 years. What this is saying is that over time this 30% farming is too high for the aquifer. This initially won't deplete the aquifer too badly, but over time this will really deplete the aquifer which would lead to farms losing their efficiency/capacity. Overall, these farms wouldn't be able to produce enough to justify depleting the aquifer. This once again happens to a similar effect for 20% farms without quite as much capacity loss. This will lower the capacity to approximately 45% which also could be considered too drastic an effect. However, with the 10% farms, farm capacity will stay at approximately 100%.



The third model describes how the economy will act as a function of time with different amounts of deforestation. The blue line once again shows 30% farms. It is also important when looking at this model to also look at the one previous. It can be seen that with the 30% farming, the economy will rise quickly but once that 30% farms are completely established, the farm capacity declines, which also exponentially decreases the economic contribution of these farms. Once farm capacity hits its minimum, the economic contribution also hits its minimum value. The 20% and 30% lines are important to take note of because this could have an impact on politics. If someone possibly wanted to get elected, one way to do this would be to have over farmed areas, which would show economic growth and help the candidate, but over time this is not a successful strategy. But, when looking at the 10% line the economy steadily grows, and then remains constant once that 10% farms is reached. This is a much more sustainable way of growing the economic output.



This model shows the relationship between aquifer volume and time. This model can also be related to the first two models displayed. This model shows that with over deforestation with 20% and 30% farming, there is this steep decline in the amount of water held in the aquifer. As this aquifer becomes depleted, there isn't enough water to nourish the farms and the capacity of these farms goes down. It appears that the only "allowable" amount of farming to sustain the aquifer would be 10% in relation to our models. What this means is that the aquifer can only have a certain amount of water taken out of it before it can't really maintain a constant level, until it is depleted by something like 90%.

5. The usefulness of this data that has been represented is not necessarily known. There are many ways that this data can be analyzed depending on what one deems important. As presented, the are certain economical, environmental, and ecological variables to consider. When considering these variables, it is important to consider the gains and losses of each. Looking at the 30% model, in the long term, this model is not a sustainable, effectively depleting the aquifer and not providing long term economic growth. However, if there needs to be a very rapid economic growth for a short period of time, this model can be useful, until a certain threshold is reached. The 10% model shows a sustainable model in terms of aquifer volume with only a small decline, but also shows a steady(linear) growth in the economic output. This can be a good model if there doesn't need to be a large amount of money to be put into the economy for the short term. The 20% model might be considered a "happy" medium of the two, however, this model still depletes the aquifer over time. This might be a better way of quickly helping the economy, but in the long term this probably isn't the best answer. On the two sides of the issue there is the environmentalist who is looking for a long-term solution that doesn't hurt the environment in any way and on the other side there is the politician who is seeking election and possibly re-election by providing positive economic figures. The environmentalist might see any amount of deforestation as problem. However, when comparing the three deforestation proposals provided previously, the most desirable would be the 10% model. Even though some forest is being replaced by farms, the aquifer is not being depleted and the long-term economic benefits are evident. One the other side of the issue, the politician seeking (re-)election might be worried about economic gain in the short term and kind of say long term effects are not their problem. Also, when getting the farmers vote, the model involving 20 or 30% farms could be something positive and get the person the vote. This an interesting debate that should be discussed further.