Quandong Development in Australia

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Introduction

Australia has seen its share of environmental problems from the hole in the ozone layer above the country, stretching from Antarctica, to the great "Emu War", where the government attempted to wither down the Emu population, a common pest in Australia. However, there is a lesser known crisis in the island nation that is causing more and more of a problem. The native Quandong tree, which produces a small fruit that can be eaten fresh off the tree or used to make a series of jams, sauces, or baked good, is becoming increasingly more endangered due to overharvesting and feral camel grazing, which have drastically reduced the number and extent of wild plants. To combat the crisis, Australia's agriculture sector must locate suitable areas that could be exploited to be the most suitable for Quandong planting and production. To be most suitable, a location must have adequate rainfall, flatness of land, soil quality, and proximity to paved roads in the area. The rainfall must be enough to supply nutrients to the Quandong; the flatness of the land is to ensure that runoff is as non-existent as possible and reduce the opportunity of runoff, and to make sure that production runs as efficiently as possible, soil quality should be enough to be able to adequately support a large amount of Quandong trees, and proximity to paved roads takes priority as well.

Methods

To deduce what areas are ripe for agricultural use and subsequently Quandong production, we would need to do three things: constrain the existing data to give us a more accurate assessment of what areas have the available resources and location to produce the best results, preferentiate areas that have variables that could be useful to making that production more efficient, and to combine those datasets to create an overall representation of the areas where the agricultural sector would get their best use. This system helps us first locate areas that are already suitable for development and production, secondly find areas where we can be efficient, and combine them to find the best possible areas where we can operate with the best planning and effectiveness.

The first task is to create a dataset that constrains the focus area in matters of precipitation fall, soil quality and slope of land. To do this, one would open ModelBuilder and determine what type of tool to use to select data to pinpoint usable criteria so that users can more accurately portray that criteria in contrast to the overall dataset that they began with. In the example presented in Figure 1, raw soil data was the primary dataset

Figure 1: This model was used to constrain soil data so that different soil types could be identified and deemed suitable or not.

presented. When put through the Feature to Raster tool, this data was restructured to detail the different soil types that make up the focus area. From this, we are able to discern areas that are suitable because they present a soil type that is beneficial to Quandong production. Other areas with unsuitable soil types were able to be ruled out as being serious candidates for agricultural development.

The second process one would have to forgo would be to create models that assist in developing preferential datasets. The main variable in this research project that uses preferential data is determining the proximity of land to paved roadways. In this category of data selection, the focus of the tool is based around prioritizing the variable rather than creating a rule that has to be applied as in the constraining datasets. For the example in Figure 2, the raw data in the "roads" set was put through ArcMap's Euclidean Distance tool to determine and map out the proximity from paved roads in the data. The farther you get from a road, the values decrease to correspond with the reduction in suitability on the 0 to 1 scale, and vice versa.

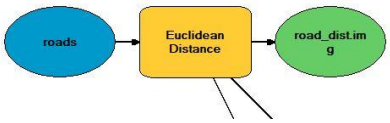


Figure 2: This model was used to create a dataset around the preference for a certain variable, in this case, roadways.

Finally, the last step in completing the analysis is to combine all of the constraining and preferential data into a complete model using the Raster Calculator tool from the Spatial Analyst extension. This will allow the user to take into account all different variables into their analysis. As with the other steps, this analysis was normalized on a 0 to 1 scale of suitability. While adding these variables into the equation, we are able to assign different weights to the individual variables, as to highlight ones that may be more important to the mission or resources of the development. For Model 1 (Figure 4), we weighted everything evenly at 0.5. For Model 2 (Figure 5), the weights were 0.2 for road proximity and 0.8 for slope preference. Lastly, Model 3 (Figure 6), had weights of 0.4 for road proximity and 0.6 for slope preference. This range offers a good depiction of the variables and how they could consistently be applied.

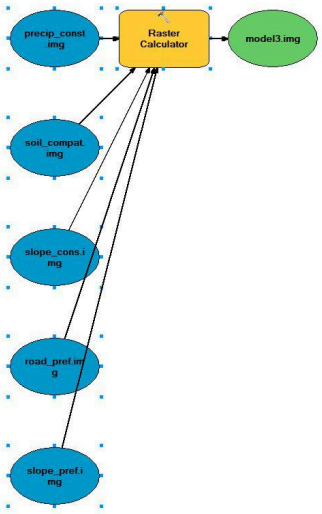
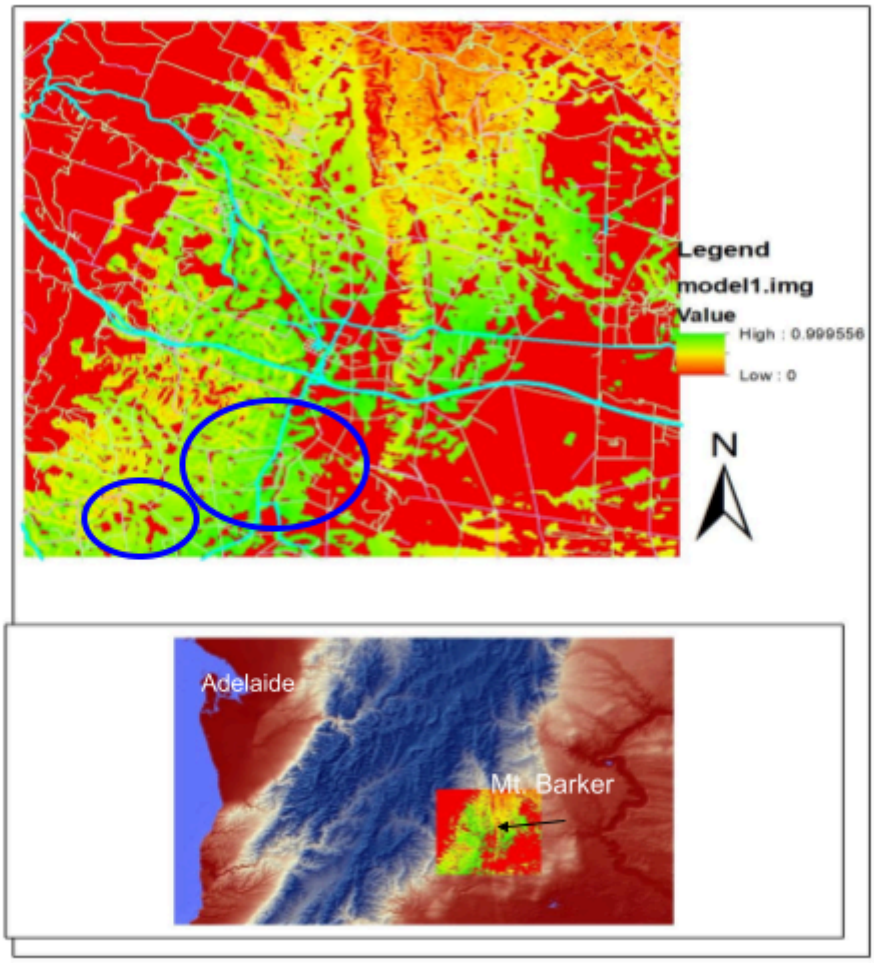


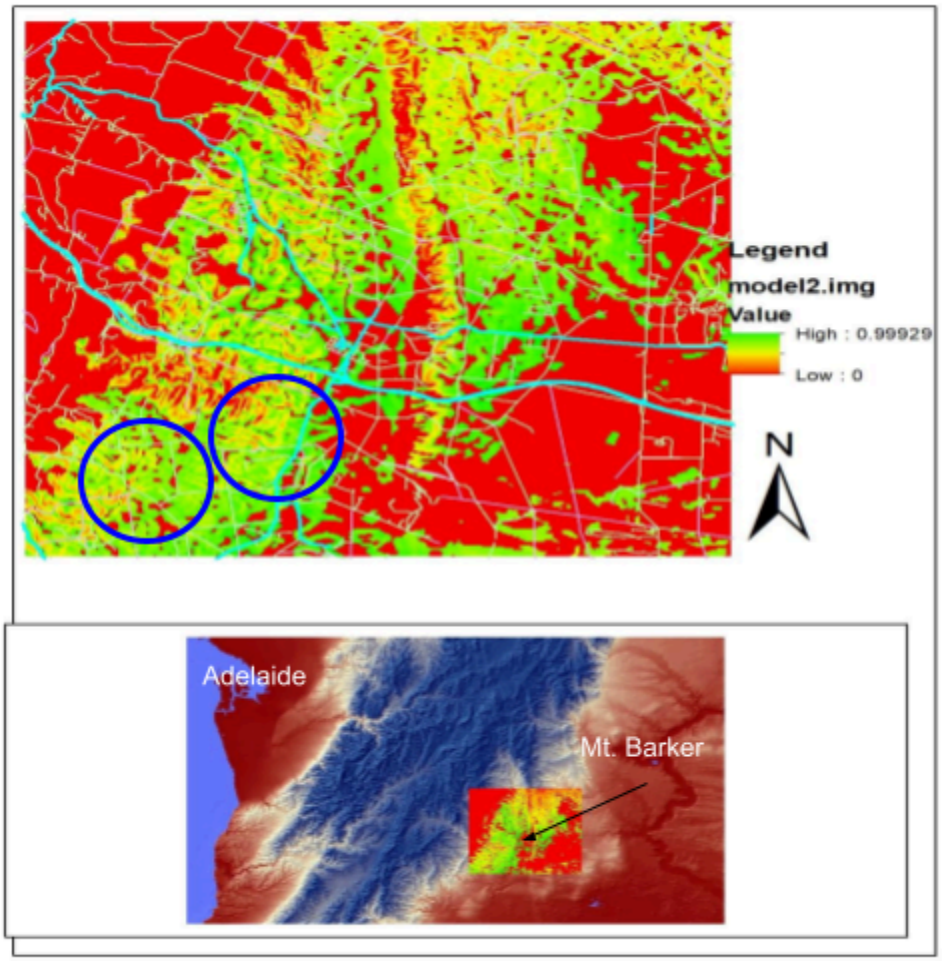
Figure 3: This combining model was created to integrate all variables so that a better overall analysis can be indentified.

Results

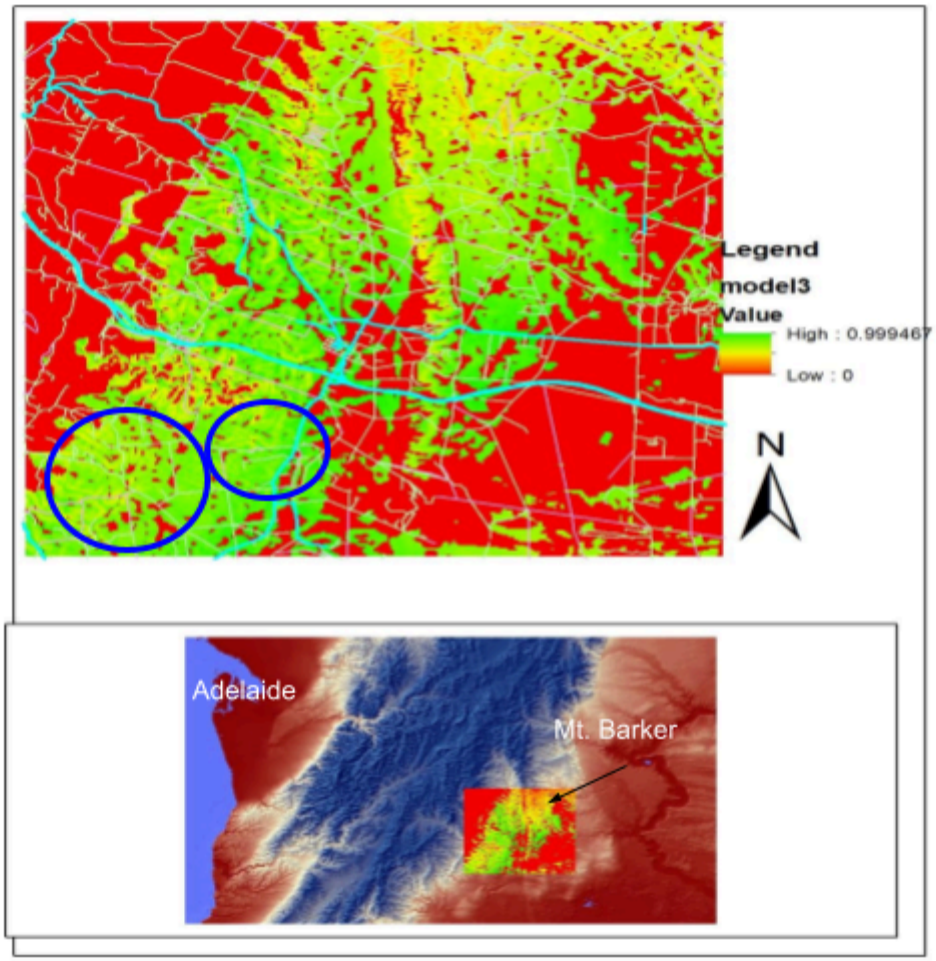
From all the weights and variables we assigned in the combination step with the Raster Calculator, we can differentiate three distinct, yet similar, models of where the best areas are suited for Quandong farming and production in the focus area. The most consistently suitable areas are marked with blue circles.



Model 1 (Figure 4)



Model 2 (Figure 5)



Model 3 (Figure 6)

In Model 1, we can see that there is the concentration of suitable land in the central section of the focus area. With an equal weight in all things, the suitable land had extreme density in the middle of the map. It is also worth noting that there is a lot of unsuitable land up in the north and eastern portions of the map. In Model 2, viewers can notice a more distinct unsuitability in the more hilly or mountainous regions of the map, where the areas below that which were previously extremely unsuitable are now more mildly up for consideration. In Model 3, the rigid regions become more considerable, while the lowlands maintain their mild considerability from Model 2.

Discussion

The results from this research project can be used to narrow down and determine the best possible location for Quandong agriculture and production. We can use the results from the maps and the corresponding weights to pinpoint the strengths and weaknesses of models, which can reveal the most promising locations. In Model 1, as stated before, the weights of all of the criteria were normal and equalized to give the best idea of locations based on the aggregate of all the variables available to the map. In Model 2, the equation is given a weight 0.8 for slope preference and a 0.2 for road preference. This is obviously placing a great deal of emphasis on the slope of the land, making sure large-size agricultural production worthwhile. This is a very important weight to have because without having a level ground, farming can become extremely difficult, especially with issues such as runoff and flooding. In Model 3, the extreme nature of Model 2 was taken to a more mild level, with the 6 point discrepancy between 0.8 points and 0.2 points was reduced to just a 2 point discrepancy between 0.6 points and 0.4 points in the weights. This was to lessen the extremity to which land around the slopes was included in the more unsuitable ratings. This is because lands with a slight slope could be managed in the agricultural industry, and should not be as scrupulously left out.

However, there are some limitations to this research project. Not all of the variables can be weighted in a way that creates a perfectly rounded analysis of the entire Quandong production issue. For example, having an area with the right amount of precipitation may yield the right amount but could be lacking in the slope preferential or the soil quality. In that way, where an area could excel in one variable, it could lack in two, but which are easily as important. All of this could also be affected by climate change in the near future, along with other external factors, environmental and economic. The arid areas of Australia could be encroaching on the areas detailed in this report, and locations that excelled in criteria like annual precipitation could soon lessen more quickly. Overall, this report can not offer a iron-clad or detailed expression of where exactly Quandong production should take precedent because without information that can interpret some of the data, betting on the model that shows the most suitable space on paper can be a gamble. For example, if proximity to paved roads was less of a factor and could expand the hinterland of where it could be most efficient to farm these trees, or areas close to the arid portions of Australia which could expand and disrupt agriculture. With the introduction of economic and environmental details, we would be able to input better weights and find a model that works the best for the focus area.

Conclusion

The results from this paper suggest that areas in the south and west of the focus area offer the most consistently suitable land for Quandong farming and production, save for any unforeseen or unintroduced information that could alter the weights or models used. Through each of the three models that test precipitation, soil quality, slope, and proximity to paved

roadways, those areas in the south and west offer near perfect conditions in all contests in each of the models. The stretch of highlands in the north east may have an adequate amount of suitable land, but as you compare models, the criteria for this area is very inconsistent, which makes it a liability to the agricultural viability of the Quandong tree. This section of the focus area is also closer to the arid regions of Australia, which could shift with the effects of global warming, given that is the impetus of climatological changes in the region. The agricultural sector should focus the instruments of Quandong farming in the most consistent suitable land, which lies in the southern and western regions of the focus area near Adelaide.

References

Archer, Mike, and Bob Beale. 2004. *Going native*. Sydney: Hodder.

“Quandong.” *AgriFutures Australia*, www.agrifutures.com.au/farm-diversity/quandong/.