Expanding UCSB Sustainability's Urban Orchard Program

Thomas Crimmel, Adriana Ocasio, Yixue Meng, Thomas Smith
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Solar Insolation

The process first took a raster DEM and used the area solar radiation tool to create a solar insolation map. To guarantee an equal weighting to each season, the four seasons were used to create four separate layers. They were then classified separately by using the optimal daily sunlight for a tree and relating it relatively to the total 24hr daylight that season. Values less than 5 relative hours were unsuitable (0). Values 5-6 or greater than 8hrs were suitable (1), and any spot 6-8hrs was optimal (2). The four reclassified layers were averaged out and then run by a "tree cutter" layer that removed solar insolation records on tree tops by multiplying all cells above 57ft by 0. This simple raster calculation allowed for the isolation of ground values.

Potable Water Access

Data for points showing access to potable water contained potable, reclaimed, and gray water links, valves, caps, hose bibs, etc. After removing only the points that could be accessed, the points were used in the Euclidean Distance tool in ArcMap with a 100 ft. limit. This division is based on the distance of current trees to their nearest potable water source in Storke Plaza. In the reclassification, 0-50 ft. in distance is defined as ideal (2), 50-100 ft. is acceptable (1), and more than 100 ft. is not acceptable (0).

Restricted Areas (RA)

Restricted areas are areas where the trees cannot be located due to various health and safety reasons as pre-specified in the Edible Landscaping Project: Citrus Tree Pilot Proposal. To give some examples: 3 ft. away from fire hydrants, paved areas, 3 ft. away from buildings, 25 ft. away from outdoor eating areas... Once each of these layers was created, they were merged together and the resulting raster was reclassified as unacceptable (0). Errors in this analysis can be due to data sources of the various locations specified, granularity, and restrictive totality.

(Solar*Water*RA) = RC 1

Raster Calc 1 (RC1)

To recall: Solar had values 0, 1, and 2, Water had values 0, 1, and 2, and RA had the value 0. These were multiplied to bring out less possible results. Results of 0 are unsuitable locations. Areas with 1 are suitable, but not ideal due to either Water or Solar access. Areas with 2 have ideal locations for either Water or Solar, and areas with 4 are ideal for Solar and Water. Because of the way we reclassified Solar, there wasn't a high concentration of 2 values. To further differentiate our data, we chose to add another layer of analysis: Kernel Density.

Proximity Analysis (Prox)

Once the resulting layer of RC1 was obtained, every raster cell was transformed into a point. The kernel density tool was used to delineate which possible locations had the highest kernel density at a hundred ft. search radius to reflect the walkable distance we determined in water proximity. Choosing a place with a higher density of locations reduces the distance caretakers need to travel between trees. When looking at the spread of the data, we made natural breaks splitting it into ideal (1) and suitable (2) locations.

(RC1+Prox)*RA = RC2

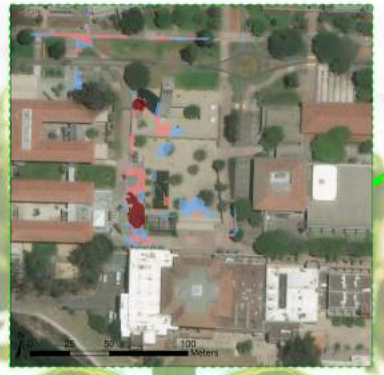
Background

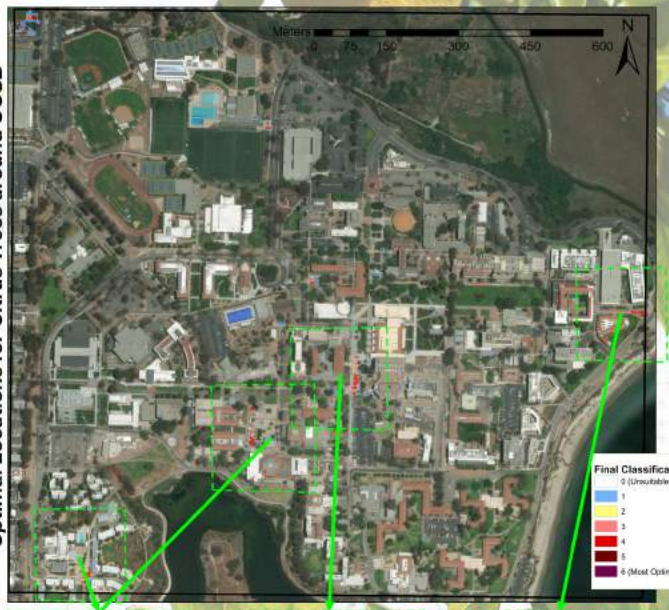
The University of California's Food Access and Security survey found that nineteen percent of the UC community meets the USDA's definitions of "very low" food security while twenty-three percent met the definition for "low" food security (Martinez et al. 2016)*. UCSB Sustainability has combined this need with recent funding towards urban agriculture to launch an on campus urban orchard project that supplies AS Food Bank with fresh produce to give back to the students. Seven citrus trees have already been successfully potted in Storke Plaza. In working to better understand *where* to expand the Urban Orchard project, our team is finding a way to make this process more expedient and the project more successful. In comparing and weighting data covering restricted areas, solar insolation, potable water accessibility, and proximity to other sites, geospatial analysis can be used to develop a map identifying the ideal locations to expand UCSB Sustainability's Urban Orchard project.

*Martinez, S. M., Maynard, K., & Ritchie, L. D. (2016). Student food access and security study.

Raster Calc 2 (RC2)

To recall: RC1 had values of 0, 1, 2, and 4 and Prox had 0, 1, and 2. RA was added to eliminate any areas recalculated as 1 due to the use of addition. Results of 0 are unsuitable locations. Areas 1-2 were suitable. Areas 3-4 were ideal locations, and areas 5-6 were very ideal locations. As can be seen below (with an understanding that not all errors have been controlled for) Storke Plaza is expectedly one of the best locations for trees.





Manzanita Village:

The area on the south side of the Carrillo Dining Common can be an optimal location due to its accessibility and exposure. However, the most optimal locations are long the central corridor which might impede pedestrians.

Girvetz Hall:

The area east of Girvetz Hall and along the Arbor is an optimal location for it is a wide open space. The issue with this location is that the Arbor is a popular area for students and faculty. Ideally, the trees would be less crowded locations for health reasons.

Elings Hall:

This area serves as a prime location due to its high solar insolation, water accessibility, and low interference with the public. The salty ocean breeze and pollution from nearby road could be an deterrent to the tree's overall health.

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