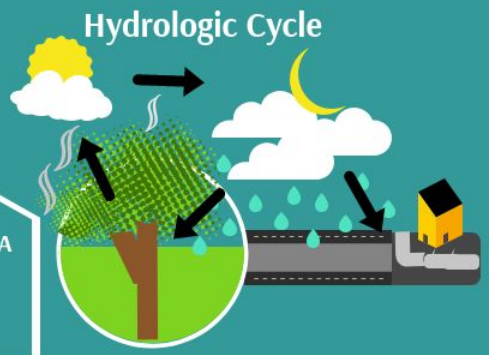
The Effect of Green Infrastructure (GI) on Mesquite Trees

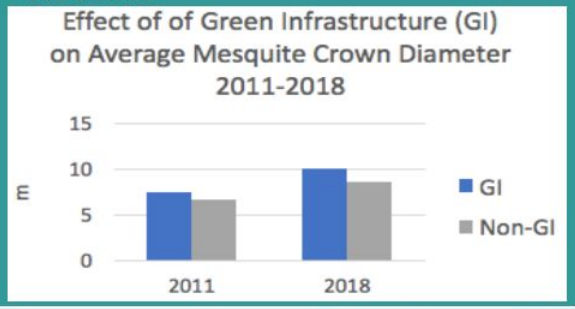
Abbeygail Anders



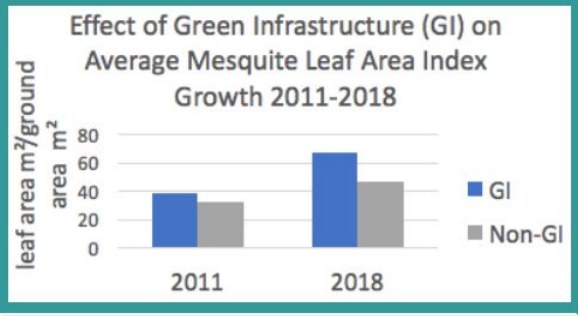
Research Questions and Methods

1) How does GI affect the physical growth of Mesquite trees in a desert environment over a 28-year time span?
Tape measurements were used to compare growth of GI and non-GI Mesquite diameter at breast height (DBH) and crown diameter (CD). A spherical densiometer was used to determine the leaf area index (LAI).
2) How does GI affect Mesquite physiology in a hot, arid climate?
A LI-COR 6400 was used to measure the rates of photosynthesis and transpiration, which were used to calculate average water use efficiency.

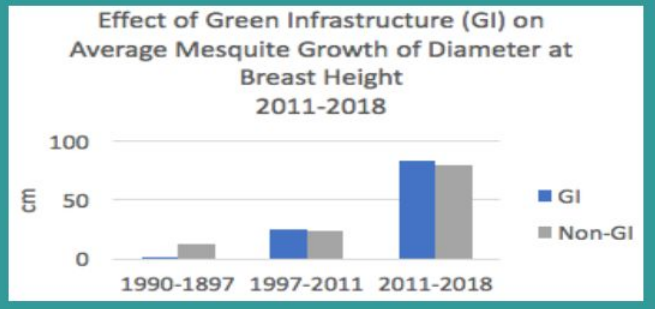
Results



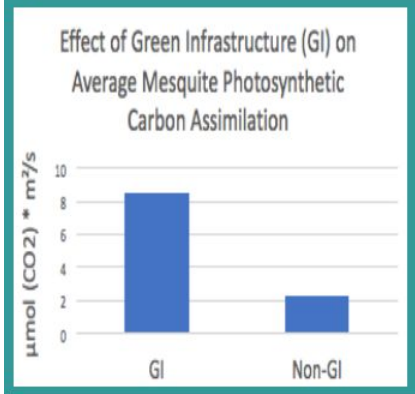
The average crown diameter of GI Mesquites grew .5597 m more and was 1.400 m greater. This means that the GI Mesquites, on average, provide more canopy coverage than the non-GI Mesquites.

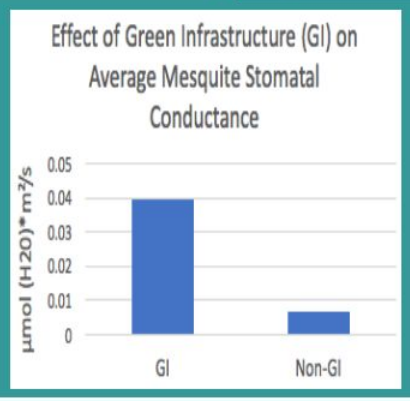


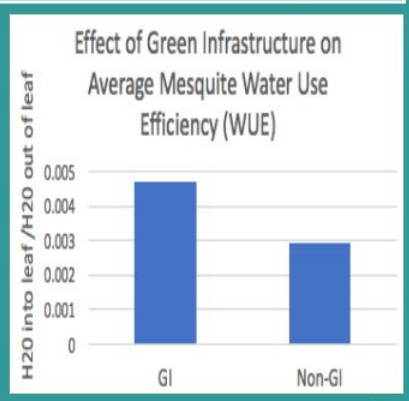
The average LAI of GI grew 13.96 LAI units (leaf area index m^2/ground area m^2) more and was 19.81 LAI units higher. This means that the average crown area of the GI Mesquites is fuller than that of the non-GI Mesquites.



The overall Mesquite DBH growth is exponential. While the non-GI DBH grew faster initially, over time, the GI DBH started growing more than the non-GI trees. Still, the average non-GI DBH grew to be 15.97 cm greater than the GI Mesquites.







The GI Mesquites had an average photosynthetic carbon assimilation (photosynthesis) rate that was 6.203 units (µmol(CO2)*m^2/s) higher than non-GI trees, meaning they were absorbing more carbon for photosynthesis. They also had an average stomatal conductance that was 0.03306 units (µmol(H2O)*m^2/s) higher, meaning they were transpiring more. WUE was calculated as the ratio between the water transpired by the leaf and the water used for photosynthesis, based off of the photosynthesis rate and equation. The average GI water efficiency was .001757 units (H2O into leaf/H2O out of leaf) higher, meaning the GI were more effectively using water than the non-GI Mesquites.

Discussion

The CD and LAI data indicate that the GI trees provide better shade coverage and the GI trees were more actively transpiring than the non-GI Mesquites. Since shade and transpiration have a cooling effect in warm climates, GI Mesquites exhibit a greater-than-normal potential to provide relief from increasing temperatures caused by climate change and the urban heat island effect. The GI trees also act as better carbon sinks because they assimilated more carbon. It can be inferred from the higher carbon assimilation and stomatal conductance rates that the GI trees are functioning better than the non-GI trees. It has been demonstrated that GI reduces stormwater runoff. This study reveals that the use of GI helps humans while also benefiting tree physiology. (Pataki et al., 2011).

Reference: Pataki, D., Carreiro, M., Cherrier, J., Grulke, N., Jennings, V., Pincetl, S., . . . Zipperer, W. (2011). Coupling biogeochemical cycles in urban environments: Ecosystem services, green solutions, and misconceptions. *Frontiers in Ecology and the Environment,9*(1), 27-36.