Abstract: Using Native Cottonwood to Improve Water Quality in Urban Streams

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Rivers and streams have economic, social, and environmental significance to people throughout the world. They are an important source of water for drinking, irrigation, recreation, and industry. In order to meet these needs, rivers and streams have been dredged, channelized, and dammed. As a result, the flow and structure of these water bodies have been greatly altered. These alterations and clearing of the vegetation along rivers for commercial development and farming, have led to a national decline in the number of healthy riparian plant communities and ecosystems which used to act as buffers for filtering pollutants.

As a part of a larger study to rehabilitate an urban riparian area along an agricultural return drainage canal that flows into the Rio Grande at the city of Sunland Park, NM cottonwood (*Populus fremontii ssp. Fremontii*) trees were planted in a test-bed to study their ability to filter water and improve water quality. Sunland Park borders El Paso, Texas and Ciudad Juarez, Republic of Mexico. Cottonwood cuttings were planted in six 40 ft x 40 ft square test plots during the growing season of 2014. Each plot contained nine plants. From the six plots, three plots were amended with a three inch layer of clinoptilolite zeolite (CZ) mixed with native sandy soil. Two additional plots with and without amendment were also created as a control. It was hypothesized that the use of low water consuming and established native riparian vegetation along with zeolite mixed with the soil, will improve water quality in nearby urban drains through filtration and phytoremediation of contaminants. Data on soil texture and chemistry, depth to groundwater, plant growth and survival were collected during the summer of 2015. Preliminary data shows that the cation exchange capacity (CEC) of soil saturated paste (soil: distilled water slurry of 1:1) ranged from 10.4 to 14.8 cmol/kg which is typical for sandy and silt loam soils. See Figure 1. The sodium adsorption ratio (SAR) for the plots ranged from 3.19 to 8.68 (Figure 2). Electrical conductivity of soil saturated paste (soil: distilled water of 1:5) ranged from 348 μS/cm to 702 μS/cm. The pH of the soils within the plots ranged from 8.2 to 8.4. This type of soil can be classified as "normal" salt-affected soils (EC of saturated paste $< 4000 \mu S/cm$ and SAR <13) and is expected to sustain cottonwood trees. The groundwater at the study site was shallow and less than 2 meters.

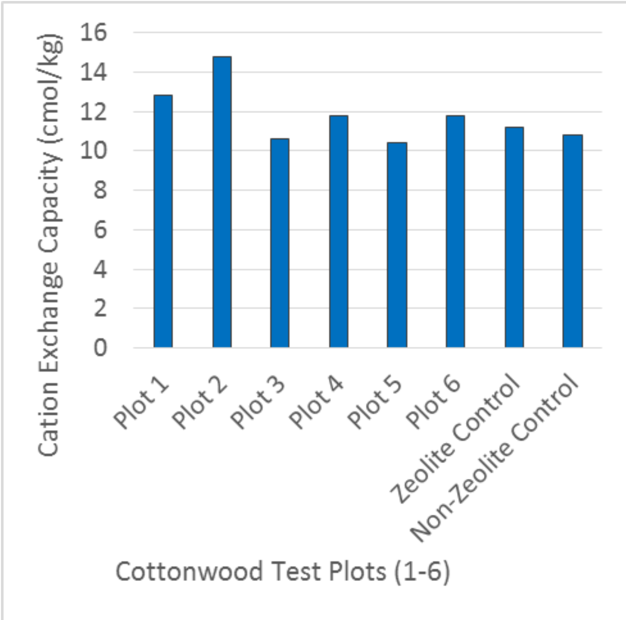

Figure 1. Cation Exchange Capacity of Soil

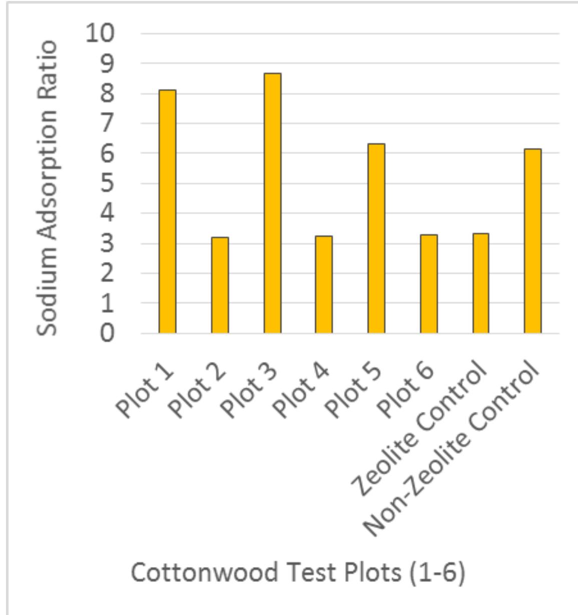

Figure 2. Sodium Adsorption Ratio of Soil

The plant assessments were performed for over the course of 48 days from beginning June 5th and ending July 22nd with an exception of July 6th week. No mortality was observed during the short period of monitoring. Overall, the plants in all of the plots were healthy and showed continuous growth. Using the data, the maximum average change in height and the average total increase in height per plot were determined and are displayed in Figure 3.

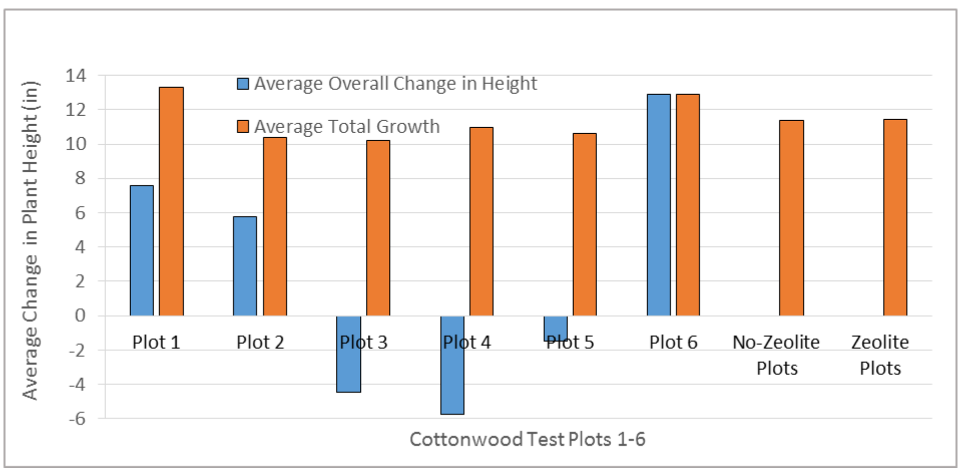

Figure 3.Average Total Versus Average Overall Change in Plant Height

The negative values shown in Figure 3 are due to damage from wildlife (i.e. beaver). No significant difference in average total growth was observed during the short period of monitoring between the cottonwoods grown in soil and in soil amended with a layer of CZ. This study is in progress and long-term data collection is anticipated including chemistry of leachate in the drainage pipes from the plots, assessment of cottonwood for use in phytoremediation, etc.