RESPONSE OF ESTABLISHED RIPARIAN VEGETATION TO MINUTE 319 ENVIRONMENTAL FLOW IN THE COLORADO RIVER DELTA, MEXICO: A CLOSE-UP VIEW.

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Minute 319 Agreement

Pilot Program and Specific objectives

- Effects of the Pulse flow on surface water and groundwater
- Persistence of the Pulse flow effects
- Base flow effects
- Did new vegetation established?
- Geomorphological effects in the channel and floodplain
COLORADO RIVER DELTA 2014 PULSE FLOW

102 MCM
83,000 AF

21 MCM
17,000 AF

9 MCM
7,000 AF
HISTORICAL HYDROGRAPH

Colorado River in the delta in 2014 in relation to median hydrograph prior to completion of Hoover Dam
(Jack Schmidt, Utah State University)
COLORADO RIVER DELTA BASE FLOWS

September 2014 Flow of 5.1 Mm$^3$ was delivered in Reach 1 through Morelos Dam. 0.5 Mm$^3$ and 6.7 Mm$^3$ was delivered via Km 18 spillway to the main channel.

In 2015 Flows were delivered to the restoration sites in Reach 2 and Reach 4.

August 2016 delivered to Reach 4.
METHODS

Preexisting Conditions

<table>
<thead>
<tr>
<th>Reach</th>
<th>Vegetation</th>
<th>Surface water present</th>
<th>Water Table</th>
<th>Ground-water salinity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Saltcedar, native shrubs, native trees</td>
<td>Yes</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Saltcedar, native shrubs, native trees</td>
<td>No</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Saltcedar, native shrubs</td>
<td>No</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Saltcedar, native shrubs, native trees</td>
<td>Yes</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Saltcedar, native shrubs, native trees</td>
<td>Lower portion</td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
REACHES
METHODS

21 TRANSECTS TO MEASURE VEGETATION COVER DISTRIBUTED IN 92 KM OF RIVER: LINE INTERCEPT. VEGETATION SURVEYS CONDUCTED BEFORE AND DURING FIRST YEAR AND SECOND YEAR AFTER THE PULSE FLOW.

NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI) WAS MEASURED BEFORE AND AFTER THE FLOWS. DURING THE GROWING SEASON IN THE RIPARIAN CORRIDOR AND POLYGONS ALONG VEGETATION TRANSECTS.

TEST DIFFERENCES IN TOTAL COVER AND GREENNESS AT THE RIPARIAN CORRIDOR LEVEL.
GREEN UP RESPONSE IN THE RIPARIAN CORRIDOR

RESULTS: CHANGES IN GREENNESS (NDVI)

F = 8.6, p-value = 0.003
RESULTS: GROUND COVER AND NDVI RELATIONSHIP

Graphs showing the relationship between NDVI and LN VEG COVER across different reaches. The equations and R² values indicate a strong positive correlation in both years, with NDVI increasing with LN VEG COVER.
Total plant cover by transect increased 12% during the Pulse flow year (2014) and increased 39% during the second year (2015) \( p\)-value = 0.03
RESULTS: CHANGES IN COVER IN THE RIPARIAN CORRIDOR BY REACH

Reach 3

Reach 4

REACH 3 PLANT COVER DECREASES FROM MAY TO OCTOBER 2014 RELATED TO A HIGH COVER NON-PERENNIAL PLANT SPECIES.
RESULTS: CHANGES IN COVER BY SPECIES

REEDS

CATTAIL/BULRUSH

% COVER

REACH

% COVER

REACH
RESULTS: CHANGES IN COVER BY SPECIES

**BACCHARIS**

- May-14
- Oct-14
- Oct-15

**ARROWWEED**

- May-14
- Oct-14
- Oct-15
RESULTS: CHANGES IN COVER BY SPECIES

**SALTCEDAR**

- May-14
- Oct-14
- Oct-15

**G. WILLOW/COTTONWOOD**

- May-14
- Oct-14
- Oct-15
CONCLUSIONS

Total plant cover by transect increased 12% during the Pulse flow year (2014) and increased 39% during the second year (2015).

NDVI increased after the pulse flow in 2014 and the highest increases (30%) were detected after the 2015 growing season.

Changes in greenness measured through NDVI were significantly correlated with the changes in total cover estimated along the transects.

Both native (Populus and Salix spp.) and non-native trees (Tamarisk spp.) experienced increases in cover ranging from about 30% in some transects to higher than 50% in others.

An increase in percentage of cover was observed after the pulse flow event, while in other transects increases were detected during the second year.

Results indicate the vegetation response was highly variable and conditioned by pre-flow conditions of the sites as well as affected by the flows.
Thanks!