

Riparian vegetation community
development along the effluent-
receiving Salt River near
Phoenix, Arizona

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Objectives

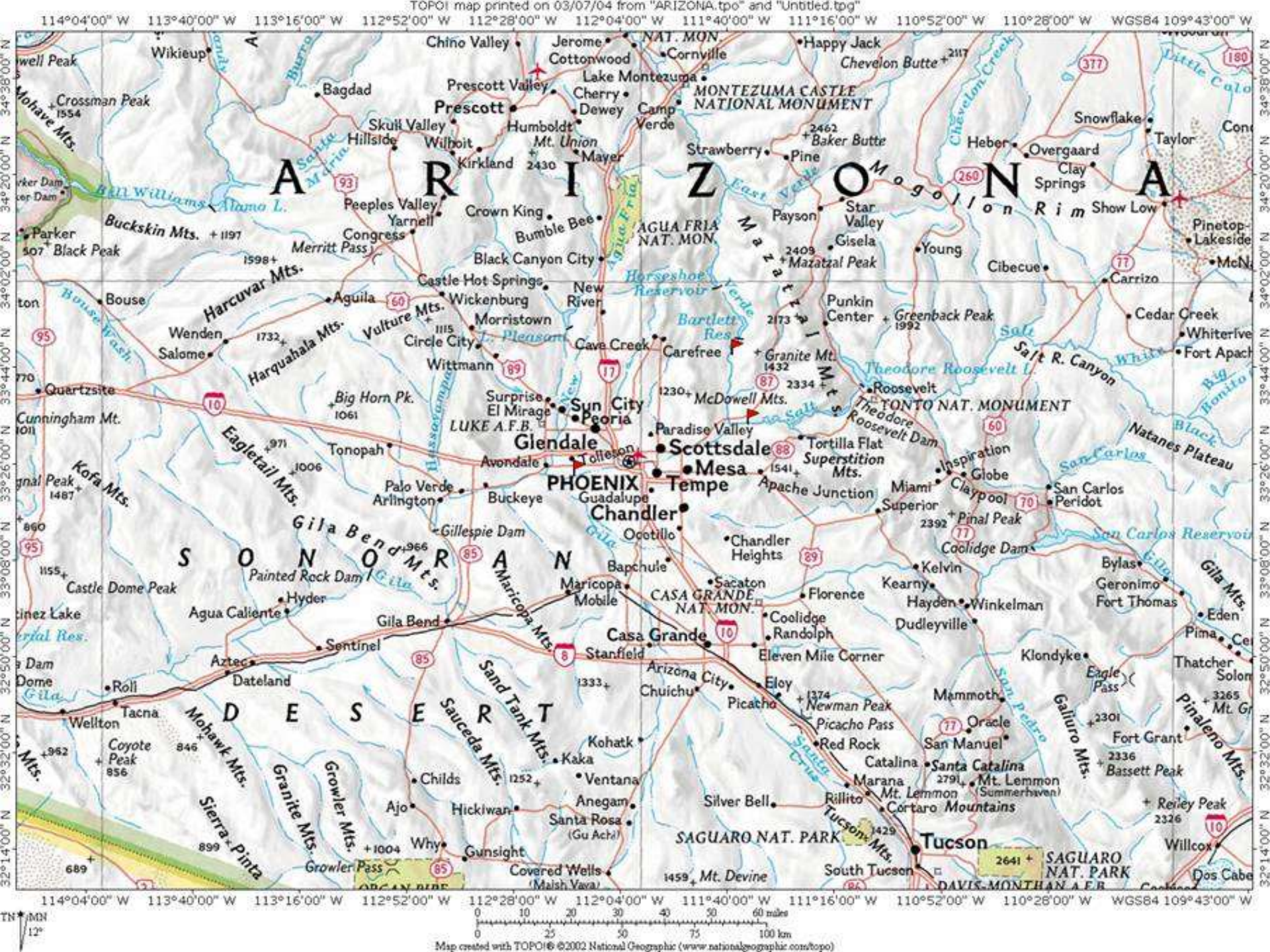
- Compare floristic community structure of an effluent dominated reach with a control reach
- Evaluate downstream trend of floristic community structure on the effluent reach
 - Distance from 91st Avenue Multi-cities Wastewater Treatment Plant (WWTP)

Effluent and riparian ecosystems

- Potential for effluent to be used as a water source to sustain riparian ecosystems
 - Effluent creates or supplements stream flow and elevates alluvial water tables
 - Effluent typically has higher nutrient concentrations (ammonia, nitrate, phosphate)

Nutrient levels and riparian-wetland vegetation

- Increased nutrient loading may alter productivity in woody species
 - Moderate nutrient loading favored cottonwood and willow seedlings, high loading favored salt cedar seedlings (Marler et al. 2001)
- Increased nutrient loads may change the assemblage of herbaceous species



TOPIC map printed on 03/07/04 from "ARIZONA.tpo" and "Untitled.tpg"

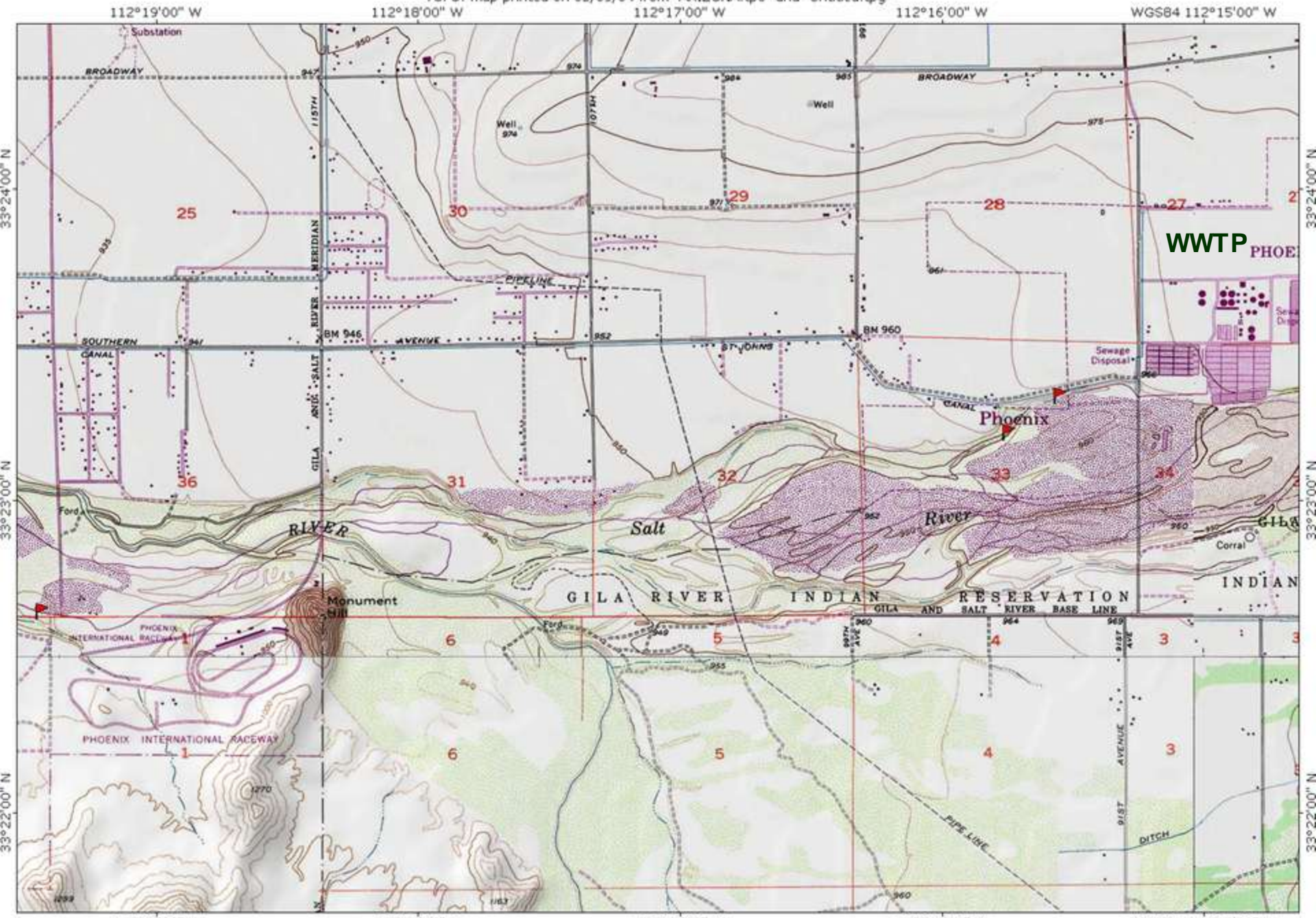
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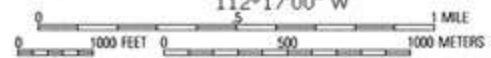
Map created with TOPIC © 2002 National Geographic (www.nationalgeographic.com/topo)

Study design

- Five transects in effluent reach
- Five transects in control reach
- Stratified random sampling along transect lines
 - 8 to 20 quadrats per transect, within vegetation patch types



TN 12° MN



111°42'00" W

111°41'00" W

111°40'00" W

111°39'00" W

WGS84 111°38'00" W

33°46'00" N

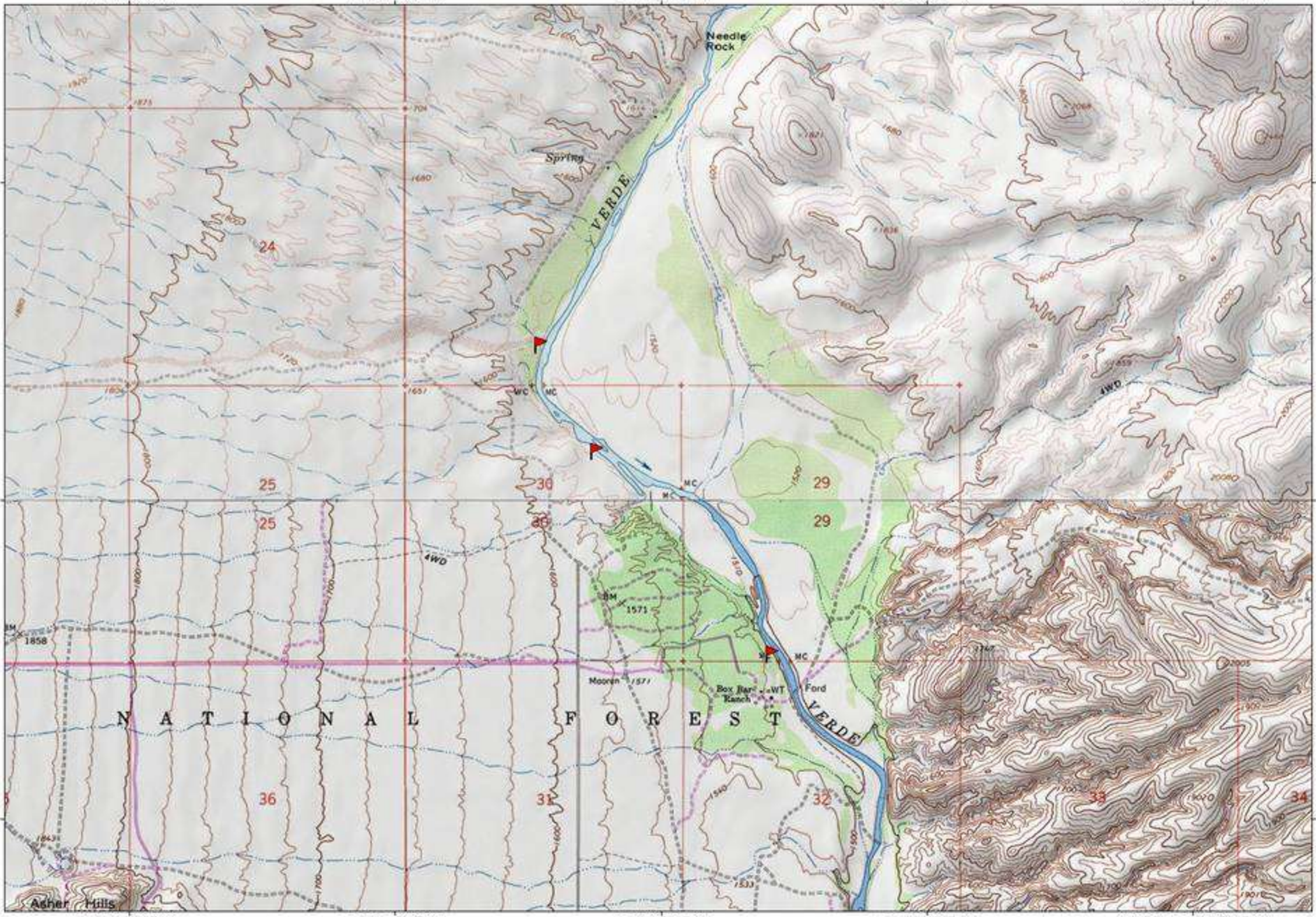
33°46'00" N

33°45'00" N

33°45'00" N

33°44'00" N

33°44'00" N



111°42'00" W

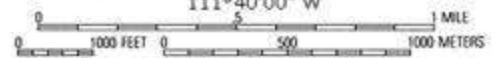
111°41'00" W

111°40'00" W

111°39'00" W

WGS84 111°38'00" W

TN 12°



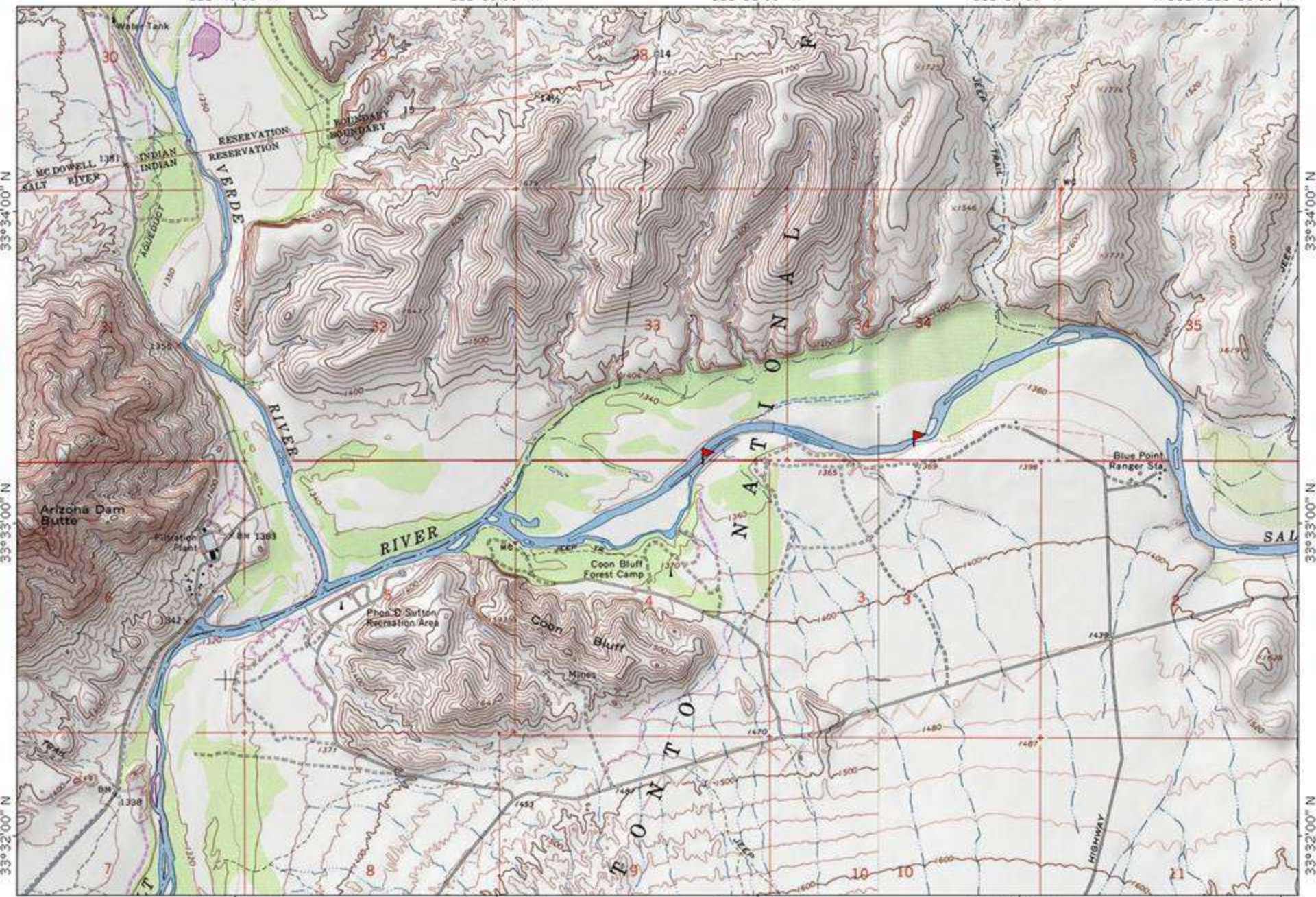
111°40'00" W

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111°38'00" W

111°37'00" W

WGS84 111°36'00" W



TN 12°

111°40'00" W

111°39'00" W

111°38'00" W

111°37'00" W

WGS84 111°36'00" W



Map created with TOPO! © 2002 National Geographic (www.nationalgeographic.com/topo)

Effluent flow near WWTP



Effluent flow, El Mirage Road





**Effluent flow,
Bullard Ave.**

Control reach, Salt River



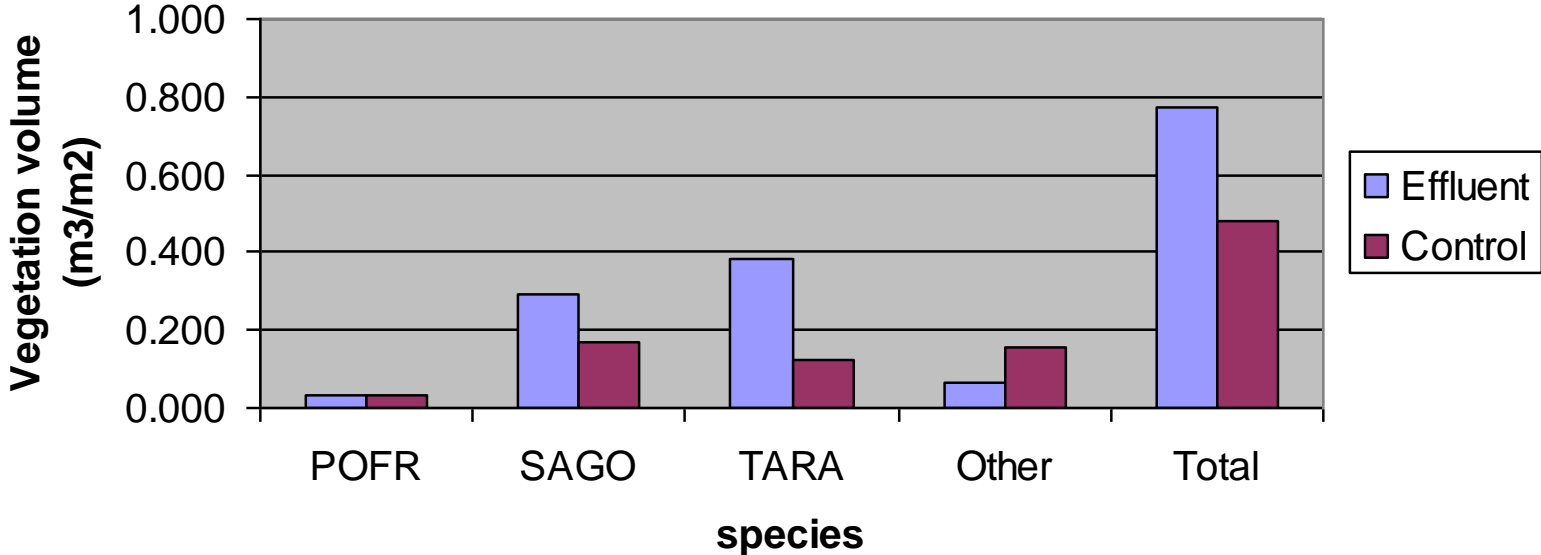
Control reach, Verde River



Riparian vegetation descriptors

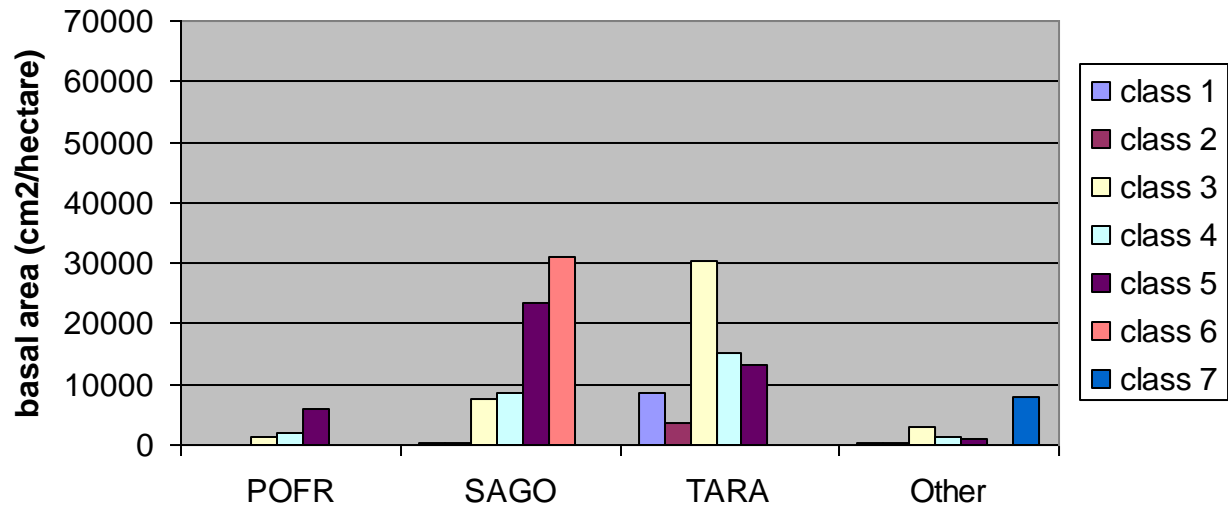
- Woody community
 - Dominant or characteristic tree species
 - *Populus fremontii* (Fremont cottonwood) POFR
 - *Salix gooddingii* (Goodding's willow) SAGO
 - *Tamarix ramisissima* (salt cedar) TARA
 - TVV (Total Vegetation Volume)
 - Density
 - Basal area

Effluent TVV values

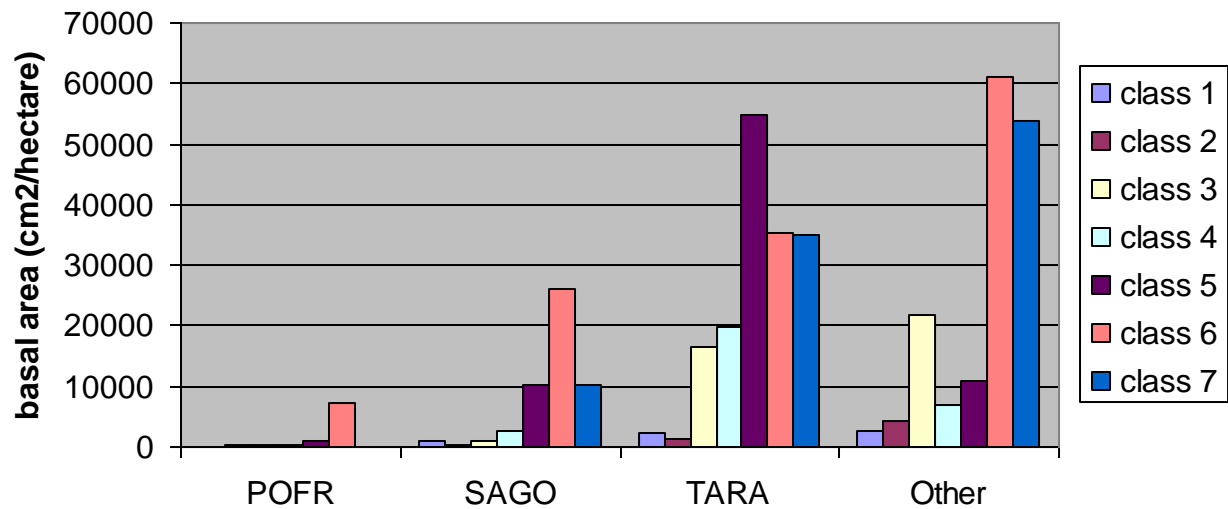


- Size classes that follow are based upon the diameter of trees at ankle height
 - Class 1 = 0.5 cm
 - Class 2 = 1.0 cm
 - Class 3 = 1.5 – 5.0 cm
 - Class 4 = 5.5 – 10.0 cm
 - Class 5 = 10.5 – 25.0 cm
 - Class 6 = 25.5 – 50.0 cm
 - Class 7 = > 50.0 cm

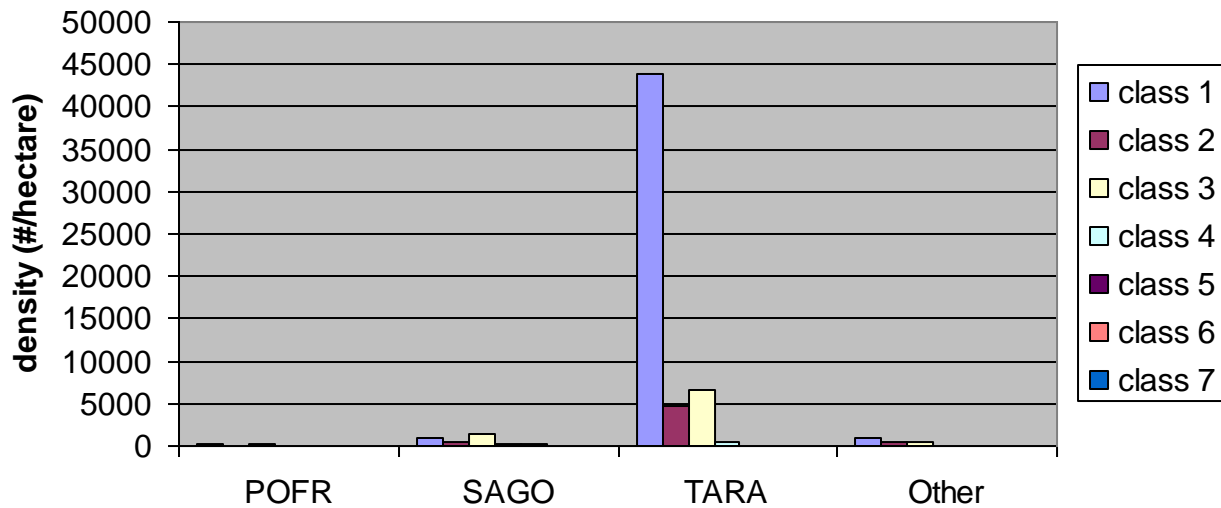
Effluent reach basal area by species



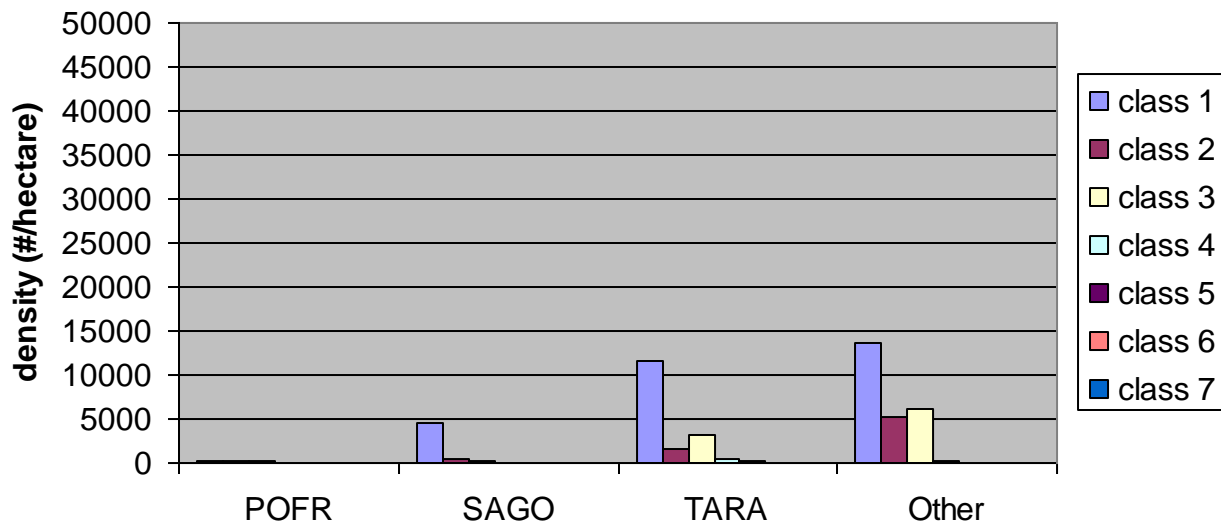
Control reach basal area by species



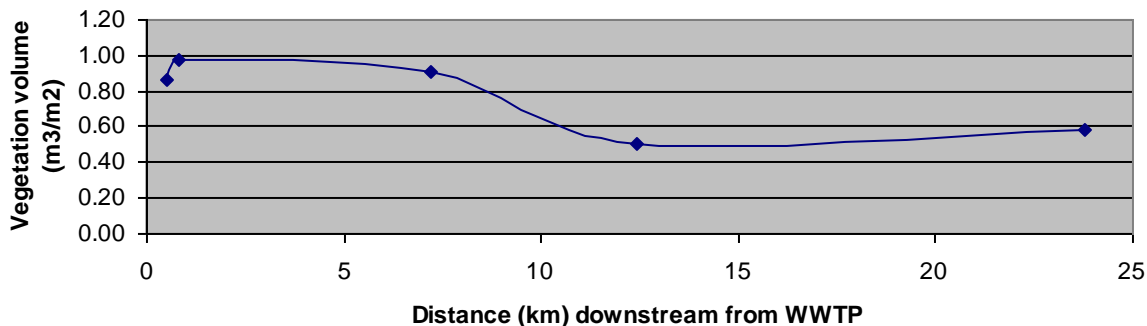
Effluent reach density by species



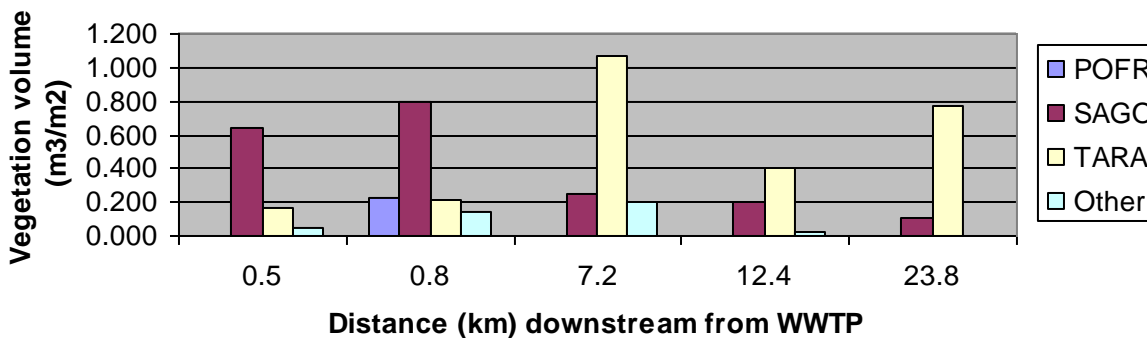
Control reach density by species



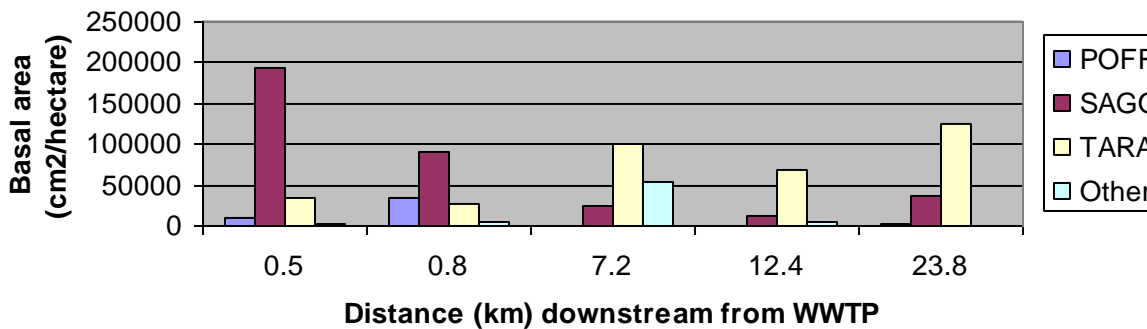
Effluent TVV for all species combined



Effluent TVV by species



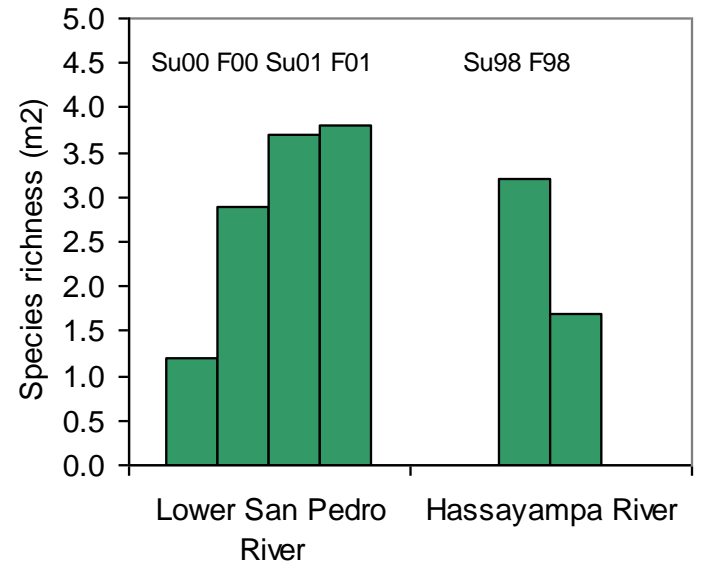
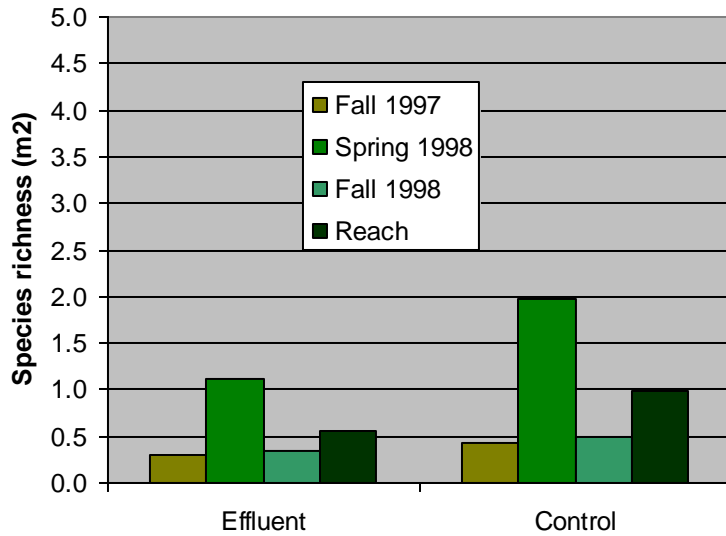
Effluent basal area by species



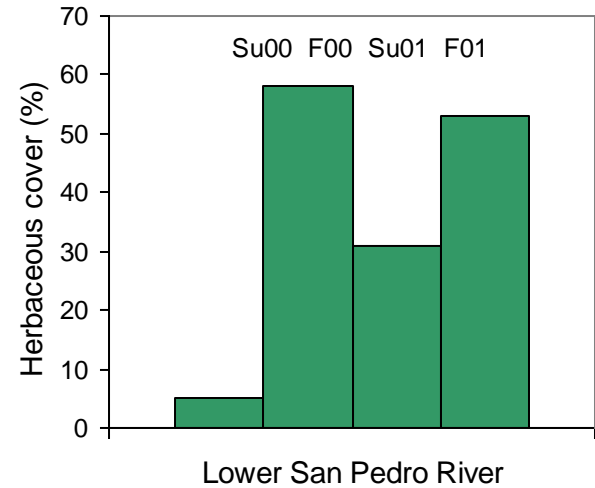
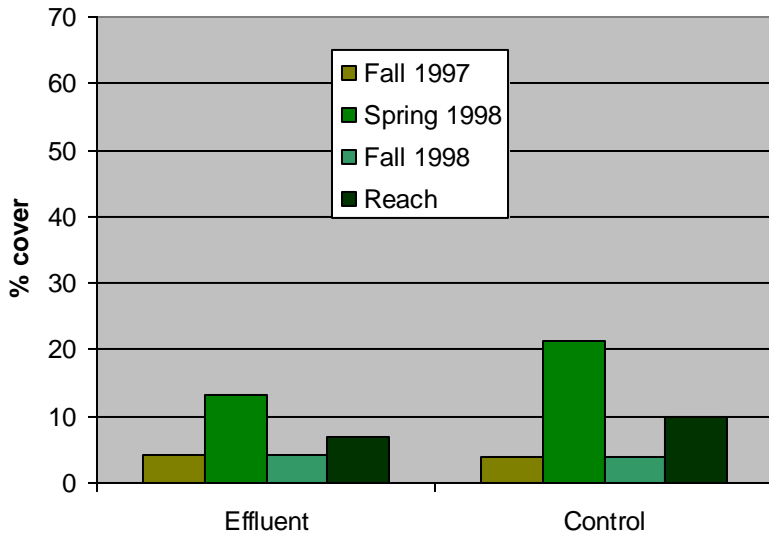
Riparian vegetation descriptors

- Herbaceous community
 - Species richness
 - Percent cover within plots
 - Native-exotic composition
 - Functional groups

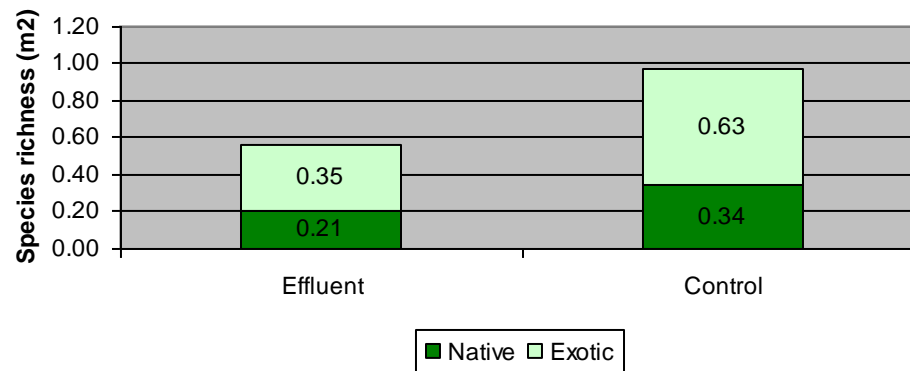
Herbaceous species richness



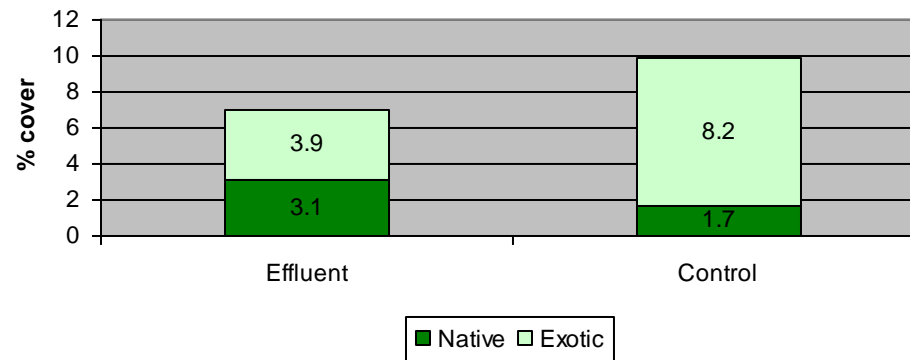
Herbaceous species cover



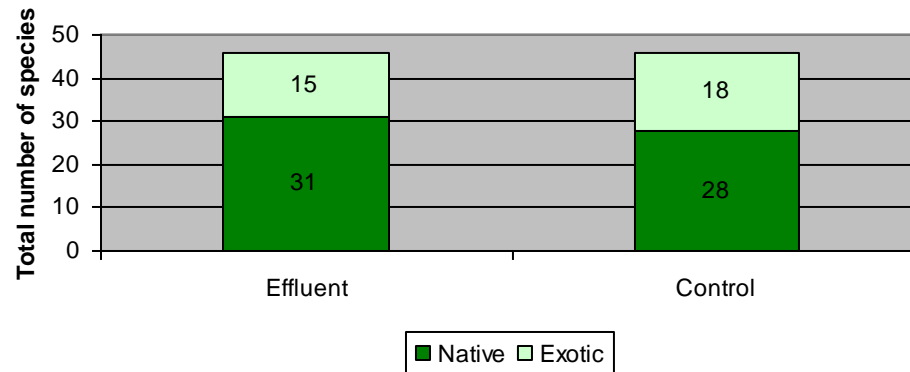
Herbaceous native-exotic richness



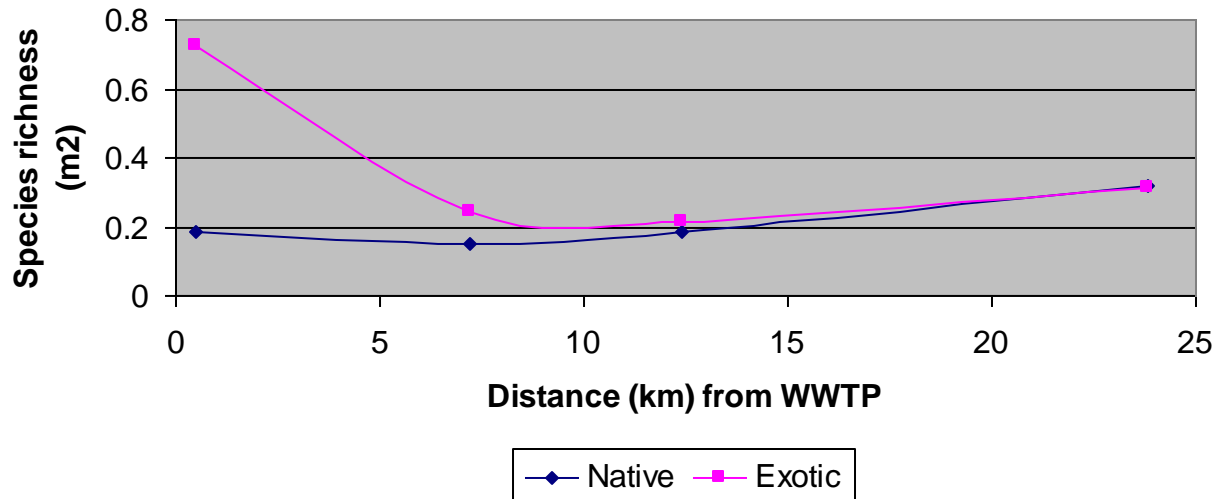
Herbaceous native-exotic cover



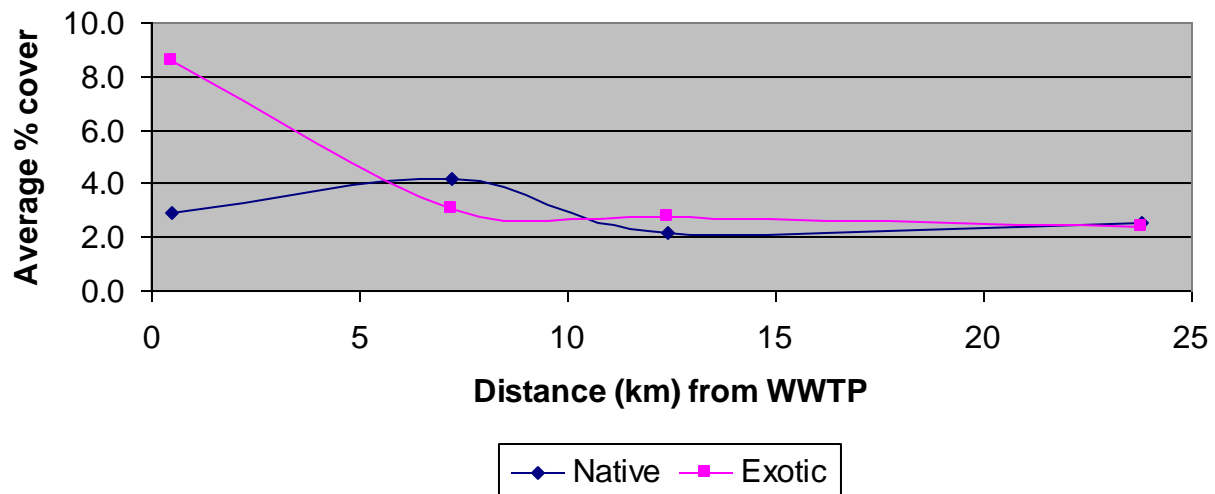
Herbaceous total native-exotic richness



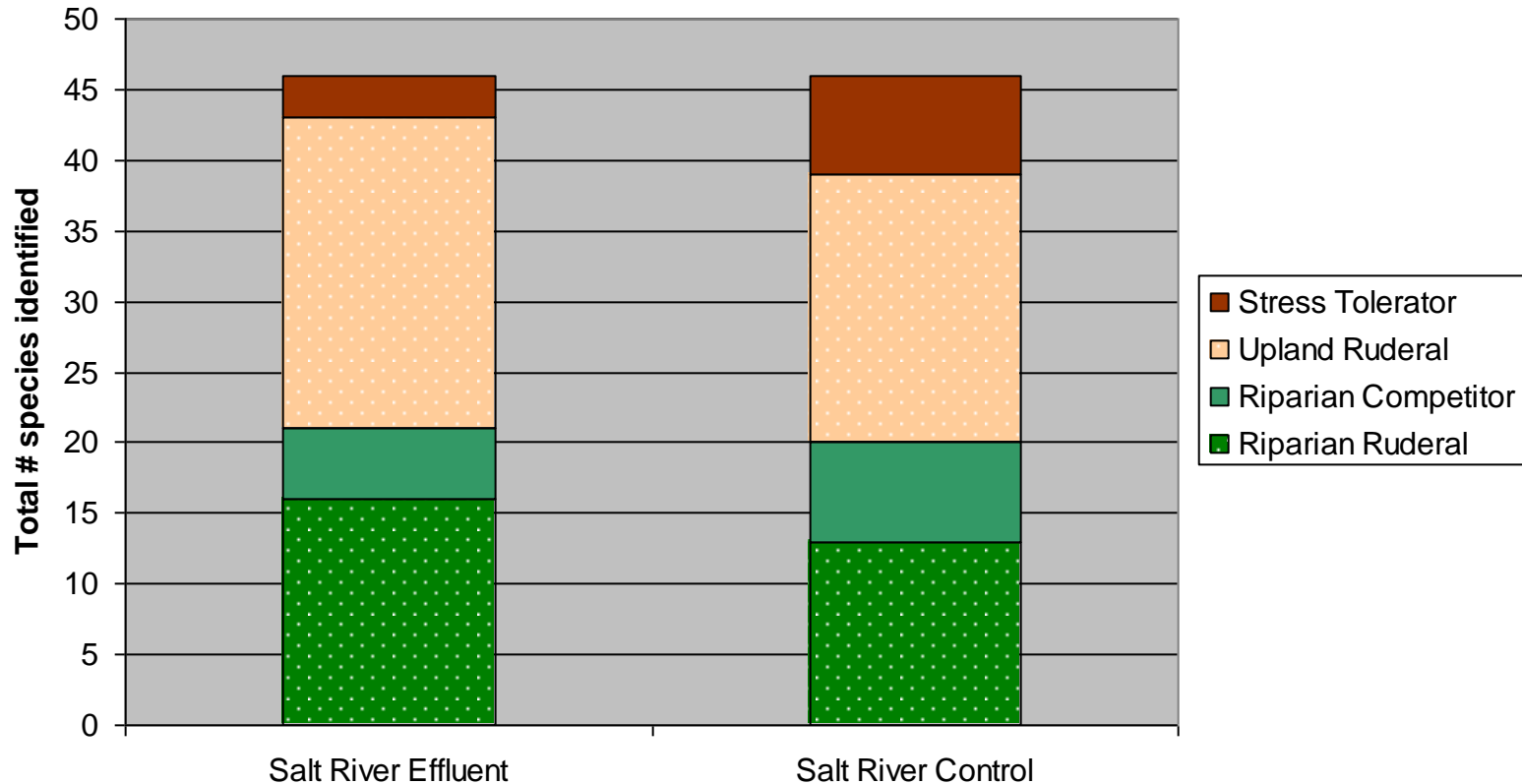
Effluent herbaceous species richness



Effluent herbaceous species cover



Herbaceous functional groups



Stress Tolerator: P or B/P, WIS 5

Upland Ruderal: A, A/P, or A/B/P, WIS 1-4

Riparian Competitor: P or B/P, WIS 5

Riparian Ruderal: A, A/P, A/B/P, WIS 5

Summary

- Woody vegetation:
 - Salt cedar prevalent/dominant on both reaches
 - Goodding's willow shows similar structural development between reaches
 - Fremont cottonwood maintains a small presence on both reaches
 - “Other” woody species are a more prominent feature of the riparian community on the control reach
- Effluent reach maintains a mature willow stand near the WWTP, which transitions into a salt cedar dominated floodplain downstream

Summary

- Herbaceous vegetation:
 - Similar low species richness and cover between reaches
 - Both reaches showing similar trends in the native-exotic species composition
 - greater richness and cover for exotics based on m^2 sampling area
 - more native species observed at both reaches
 - Functional group composition of species similar between reaches

Conclusion:

- The effluent reach, with the exception of the shrub species, shows structural development and complexity that is similar to that seen on the control reach
- Management Implications:
 - Effluent release from the WWTP allows for the establishment and/or maintenance of a riparian vegetation community that displays many of the structural components found on the non-effluent receiving control reach

Verde River

