The Albuquerque Overbank Project

A Model for Large River Riparian Ecosystem Restoration in the Southwest

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SUMMARY

In 1998, the Albuquerque Overbank Project (AOP) was initiated as a pilot riparian ecosystem restoration project in the Albuquerque reach of the Rio Grande. Its purpose was to evaluate the efficacy of using exotic shrub removal, bank lowering, and overbank flooding to reestablish Rio Grande cottonwoods and rebuild a diverse patch mosaic of native riparian vegetation along the river. While the Rio Grande has been highly modified over the past century, many of the essential elements of functionality and biodiversity are still extant. Our goal was to take advantage of those remaining attributes in a river-aided ecosystem restoration and to do so in a cost effective manner.

On a point bar adjacent to the main channel, dense exotic Russian olive (*Elaeagnus angustifolia*) was removed, a portion of the bar lowered by approximately 1 m to be within reach of typical spring runoff events, and channels and islands constructed to aid the establishment of native cottonwoods, willows, and a diverse assemblage of shrubs, grasses, and forbs. The cost of the manipulation was approximately $12,350/ ha ($5,000/ac).

In 1998, 1999, and 2001, the site flooded during peak discharges between 85 and 113 cms (3,000 and 4,000 cfs) in May through June. After the initial 1998 flood, there was a large germination event of Rio Grande cottonwoods (*Populus deltoides* ssp. *wislizeni*) that resulted in the establishment of 10,070 saplings/ha (4,077/acre) in that year. Through a process of self-thinning due to shading and beaver herbivory, the cottonwood numbers stand at about 2,500 stems/ha (1,000/acre) at the end of 2013. The highest densities of cottonwoods occurred in and along the constructed channels, and to a moderate degree on the island between the channels. Lowest densities were in lower channel areas characterized by deposits of clay sediments, or high salinities, and on an elevated terrace where Russian olive had been removed but not lowered and flooded. In addition, sites on the fill material from the excavation of the bar had little cottonwood recruitment. Hence, cottonwood establishment, while high in some areas, was patchy across the site.

Although the site had been cleared, exotic trees Russian olive and salt cedar (*Tamarix ramosissima*) shrubs regrew from root-crown remnants and seed, and were approaching densities of 1,355 stems/ha (550/ac) by the end of 2002. Yet cottonwoods still clearly dominated the site. After 2003, the Russian olives were retreated through cutting and herbicide applications directly to the cut stems. Numbers

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dropped to 198 stems/ha (80/ac) in 2007 but have risen to 450/ ha (182/ac) in 2013. This suggests that minor retreatment of exotics will still be needed on a decadal basis.

Beavers have significantly impacted cottonwood growth and stand development. Nearly half of the established cottonwoods have been browsed by beaver, while only about a third of the exotics, mostly Russian olive, were impacted. Many cottonwoods were killed outright, but most browsed trees are resprouting from multiple stems at the base (the majority also remain less than 2m (6 ft) in height). They key is whether densities will be high enough through time to allow the development of a forest without some beaver protection.

The construction of topographic features such channels and islands and overbank flooding led to increased vegetation patch diversity. By 2013, there were over 10 different tree, shrub, and herbaceous patch types compared to the nearly uniform adjacent mature sparse forest. Large woody debris can also play a key role increasing patch diversity and fostering cottonwood reproduction. For example, a large stump became logged at various locations along the channel edge creating sand bars behind it that were followed by the establishment of new willow and cottonwood stands.

Species diversity was also much higher compared to the forest. Cumulative species richness has continued to increase over the 15 years, and 126 plant species have been recorded so far, of which 75% were native. But canopy cover of exotic grasses had become a significant issue by 2013, with nearly half the graminoid cover dominated by introduced species, particularly ravennagrass (*Saccharum ravennae*), a Class A noxious weed. Approaches to the latter's control is becoming an important issue in Rio Grande restoration.

The outcome suggests that the AOP site can be a useful model for large river riparian ecosystem restoration that utilizes bar lowering followed by overbank flooding and low-intensity management. Restoration success, though, may be dependent on the timing and duration of flooding, the design of the constructed floodplain, soil conditions, the availability of seed sources, and the subsequent adaptive management strategies implemented. Accordingly, we would recommend that additional AOP-style restoration sites be initiated in other segments of the Middle Rio Grande to further refine overbank flooding prescriptions. But the success of AOP in itself is encouraging for the prospects of multi-agency cooperation in restoring patch diversity and the associated compositional, structural, and functional qualities of the riparian landscape in the Middle Rio Grande Valley.

AOP and ecosystem restoration goals:

- Reestablish ecosystem patch diversity and associated structure, composition, and functionality
- Rejuvenate forests through natural regeneration of cottonwood and willow trees
- Use available water and sediment to accomplish restoration and sustain the ecosystem services

- AOP site construction.

AOP site treatment was begun in March 1998 with the clearing of a Russian olive stand and the lowering of the bar by approximately 0.66 m (two ft) (A). Materials were moved onto an adjacent sandbar downstream (B). Channels and low-lying islands were excavated into the new bar to create microhabitats for cottonwood regeneration (C and D).

- The upper AOP bar through time; floods ranged from 3,000 to 4,000 CFS.

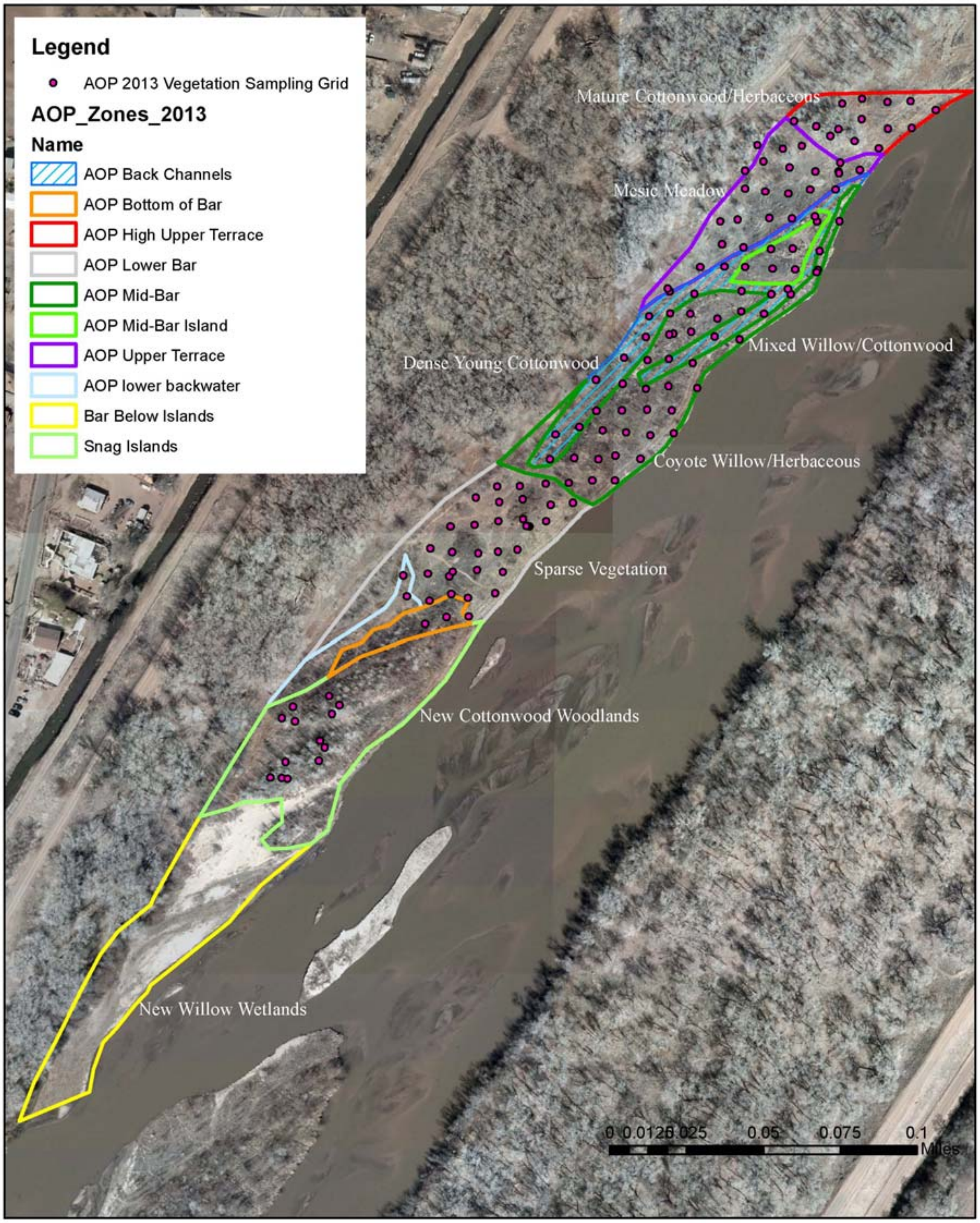
1998

1999

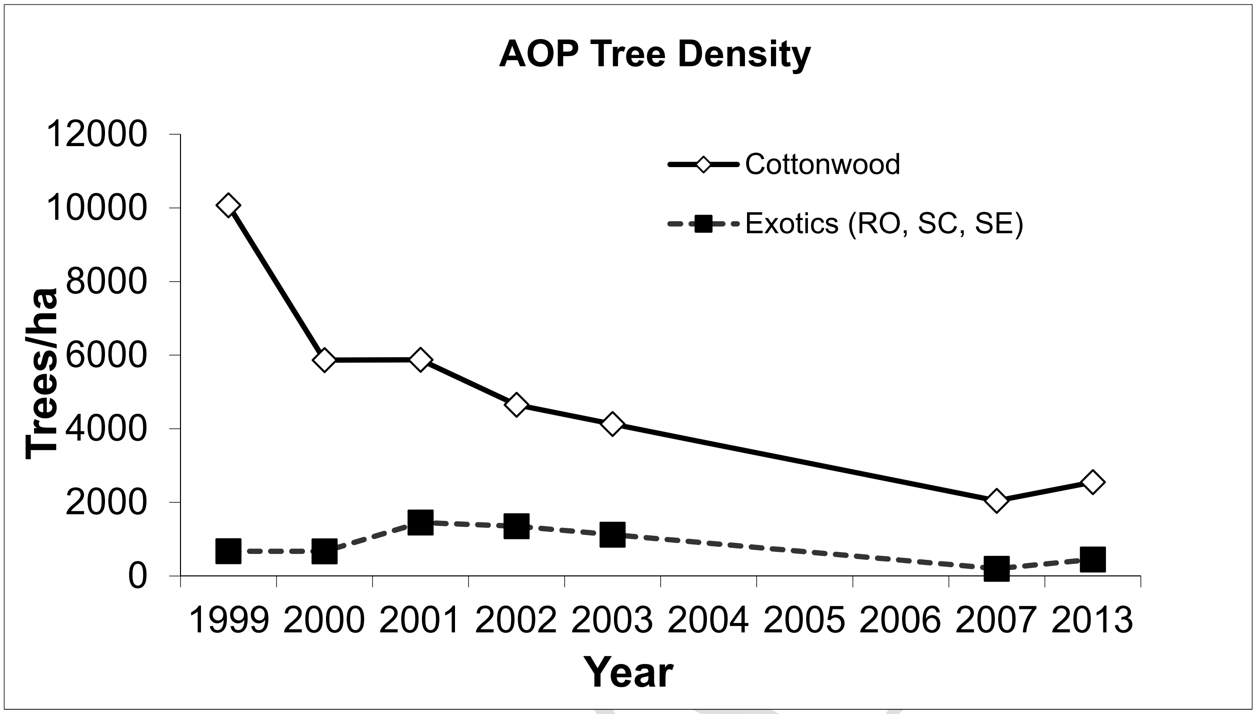
2003

2007

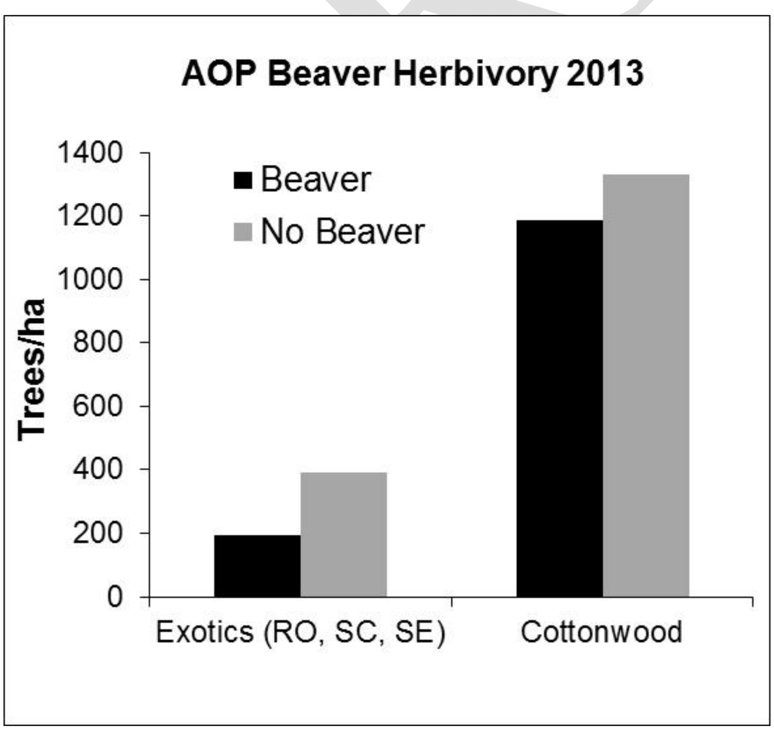
- AOP zones, patch types, and sampling points



• Cottonwoods dominate the trees, but Russian olive needs periodic retreatment at low levels

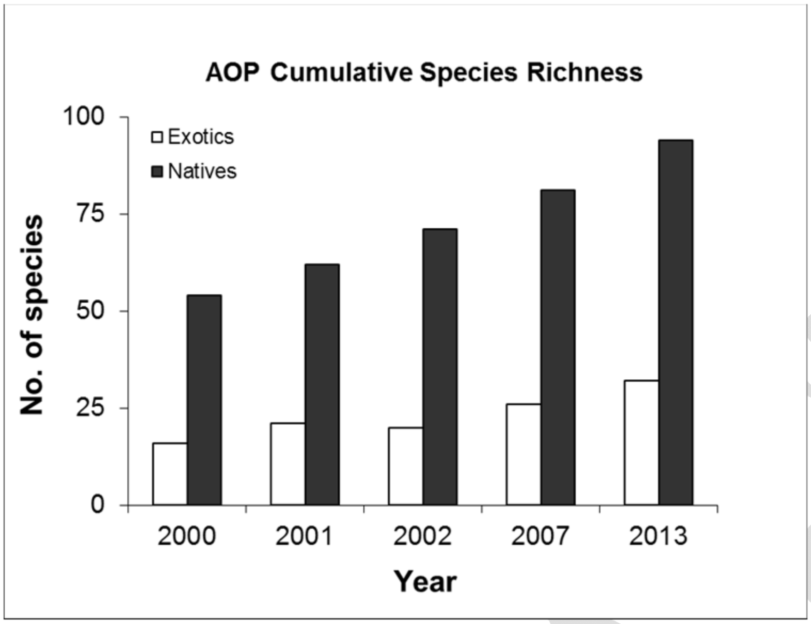


• Beavers are a significant impact on cottonwood growth



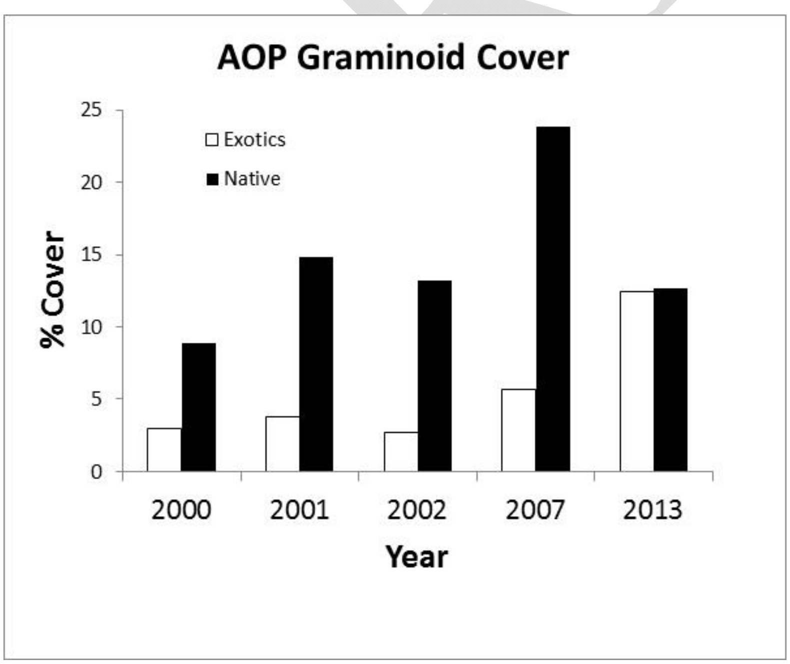
How many trees make a forest, and in what pattern?

- Plant species diversity is high and dominated by natives



High plant diversity leads to high faunal divesity (viceroy butterfly AOP 2013).

- Exotic grass cover is becoming a problem



Ravennagrass

(*Saccharum ravennae*)

- Large Woody Debris (LWD) matters; behind new sand bars form and subsequent vegetation patches.