Effects of River Modification on the Soil Seed Bank of the Salt River, Arizona

A case study of an arid region river

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Abstract

River modification has been documented in the southwestern United States, with more than 25% of historically free-flowing river reaches having been substantially changed. This study focuses on the Salt River, which has been modified through river diversions and damming. The objectives of this study are to determine how the riparian soil seed bank is affected by long-term river damming and diversion and by the return of flow and small flood pulses from constructed urban tributaries. We compare the soil seed bank of the Salt River with that of a wild river reach from California. We expect composition and diversity of the soil seed bank to differ between reaches with different flow regimes, and we expect the degree of similarity between the riparian vegetation and the soil seed bank to be lower as the flow regime changes from perennial to intermittent. The soil seed bank in the perennial reach should have a higher diversity and more similarity with the extant vegetation than in the intermittent reach. The soil seed bank of intermittent reach may be similar to that of the perennial reach in terms of diversity and similarity with the extant vegetation, but the composition is likely altered due to the loss of upstream-downstream connectivity and to inputs of a wide range of species from the floodplain.

INTRODUCTION

The Salt River, located in the southwestern United States, exemplifies the major features of a disturbed riparian environment. The river’s headwaters are in the Santa Catalina Mountains, and the river flows through a semiarid, alluvial valley between the Mazatzal and Bradshaw mountain ranges. It is an important water source for the Phoenix metropolitan area, and urban development has often led to the modification of the river. The Salt River is a critical habitat for a large number of aquatic and riparian species. However, the river has been severely modified through river diversions and damming. The objectives of this study are to determine how the riparian soil seed bank is affected by long-term river damming and diversion and by the return of flow and small flood pulses from constructed urban tributaries. We compare the soil seed bank of the Salt River with that of a wild river reach from California.

The study sites for this investigation are located along a 10-mile stretch of the Salt River between the Salt-Verde and Salt-Gila River confluences. The region can be divided into three zones for the purposes of this study. The upper zone is located in the city of Phoenix, the middle zone is located in the city of Mesa located between Granite Reef and other dams, and the lower zone is located in the city of Tempe located between the Granite Reef and other dams. The middle zone is comprised of two subzones: the upper subzone is between Mesa and Tempe, and is a direct result of the presence of storm drains which provide water from urban runoff. The lower subzone is comprised of two subzones: the upper subzone is between Tempe and Phoenix, and is a direct result of the presence of storm drains which provide water from urban runoff.

METHODS

The study sites for this investigation are located along a 10-mile stretch of the Salt River between the Salt-Verde and Salt-Gila River confluences. The region can be divided into three zones for the purposes of this study. The upper zone is located in the city of Phoenix, the middle zone is located in the city of Mesa located between Granite Reef and other dams, and the lower zone is located in the city of Tempe located between the Granite Reef and other dams. The middle zone is comprised of two subzones: the upper subzone is between Mesa and Tempe, and is a direct result of the presence of storm drains which provide water from urban runoff. The lower subzone is comprised of two subzones: the upper subzone is between Tempe and Phoenix, and is a direct result of the presence of storm drains which provide water from urban runoff.

In April 2004, we measured substrate size and infiltration in the Salt River using a fixed soil core and a falling head permeameter. Samples were collected from a depth of 10 cm. The substrates were dried and then sieved to separate the different size fractions. Substrate size was defined as the percentage of the total substrate volume that passed through each sieve. The percentage of substrate size that passed through each sieve was determined using a particle size analyzer. Substrate size was defined as the percentage of the total substrate volume that passed through each sieve. The percentage of substrate size that passed through each sieve was determined using a particle size analyzer.

RESULTS

We expect composition and diversity of the soil seed bank to differ between reaches with different flow regimes, and we expect the degree of similarity between the riparian vegetation and the soil seed bank to be lower as the flow regime changes from perennial to intermittent. The soil seed bank in the perennial reach should have a higher diversity and more similarity with the extant vegetation than in the intermittent reach. The soil seed bank of intermittent reach may be similar to that of the perennial reach in terms of diversity and similarity with the extant vegetation, but the composition is likely altered due to the loss of upstream-downstream connectivity and to inputs of a wide range of species from the floodplain.

EXPECTED RESULTS

Seed banks will be compared to above ground vegetation by determining biomass coefficients of similarity. The study sites for this investigation are located along a 10-mile stretch of the Salt River between the Salt-Verde and Salt-Gila River confluences. The region can be divided into three zones for the purposes of this study. The upper zone is located in the city of Phoenix, the middle zone is located in the city of Mesa located between Granite Reef and other dams, and the lower zone is located in the city of Tempe located between the Granite Reef and other dams. The middle zone is comprised of two subzones: the upper subzone is between Mesa and Tempe, and is a direct result of the presence of storm drains which provide water from urban runoff. The lower subzone is comprised of two subzones: the upper subzone is between Tempe and Phoenix, and is a direct result of the presence of storm drains which provide water from urban runoff.

REFERENCES


Papers are the opinions of the authors and do not reflect the views of the U.S. Army Corps of Engineers, or the Department of the Interior.

Table 1. Vegetation patch types expressed relative to the Salt River, Az.

<table>
<thead>
<tr>
<th>Patch Type</th>
<th>Size</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Shrubland</td>
<td>3 plots</td>
<td>Phoenix</td>
</tr>
<tr>
<td>Scrubland</td>
<td>3 plots</td>
<td>Phoenix</td>
</tr>
<tr>
<td>Scrubland</td>
<td>3 plots</td>
<td>Tempe</td>
</tr>
<tr>
<td>Woodland</td>
<td>3 plots</td>
<td>Tempe</td>
</tr>
<tr>
<td>Woodland</td>
<td>3 plots</td>
<td>Phoenix</td>
</tr>
</tbody>
</table>

Fig. 1. Soil seed bank study sites. (A) Study site locations within each vegetation patch type. (B) Area of study sites. (C) Area of study sites with vegetation patch types. (D) Area of study sites with vegetation patch types and rivers. (E) Area of study sites with vegetation patch types and rivers. (F) Area of study sites with vegetation patch types and rivers.

Fig. 2. Map of study sites. (A) Study site locations within each vegetation patch type. (B) Area of study sites. (C) Area of study sites with vegetation patch types. (D) Area of study sites with vegetation patch types and rivers. (E) Area of study sites with vegetation patch types and rivers. (F) Area of study sites with vegetation patch types and rivers.