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The Effects of Floodplain Restoration on Biodiversity

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Introduction

- During the colonial era, numerous mills and dams were built in Pennsylvania. This and other intensive land uses led to sediment eroding from upstream and burying wetlands. The accumulated sediment is known as legacy sediment¹.
- There has been a significant loss of wetlands throughout the centuries, with many of them in the Piedmont region being buried under thick layers of legacy sediment as shown in Figure 1 below².



Figure 1. Pre-restoration (left) and post-restoration (right) of Big Spring Run. The sediment bank on the left is roughly 2 meters in height. Photos courtesy of <http://www.bsr-project.org/>.

- The removal of legacy sediment is a new technique used to restore wetlands, mainly with the intent being to improve water quality³. However, a restored wetland as shown by Figure 1 may also have numerous benefits on the biodiversity within the area.

GOAL: To evaluate the effects of floodplain wetland restoration on the biodiversity.

Methods

- Three restoration sites conducted by LandStudies in Lancaster County, Pennsylvania were selected as shown by Figure 2.
- Vegetation was sampled using random transects with 1-meter square quadrats distanced 10 meters apart starting at the uplands.
- PictureThis app was used to identify unknown plants in the field, specimens were collected and identified through a variety of identification keys.
- Salamanders and tadpoles were haphazardly sampled with dip-nets with 300-600 dips depending on site as seen in Figure 3.



Figure 3. Demonstration of sampling using dip-nets at Big Spring Run.

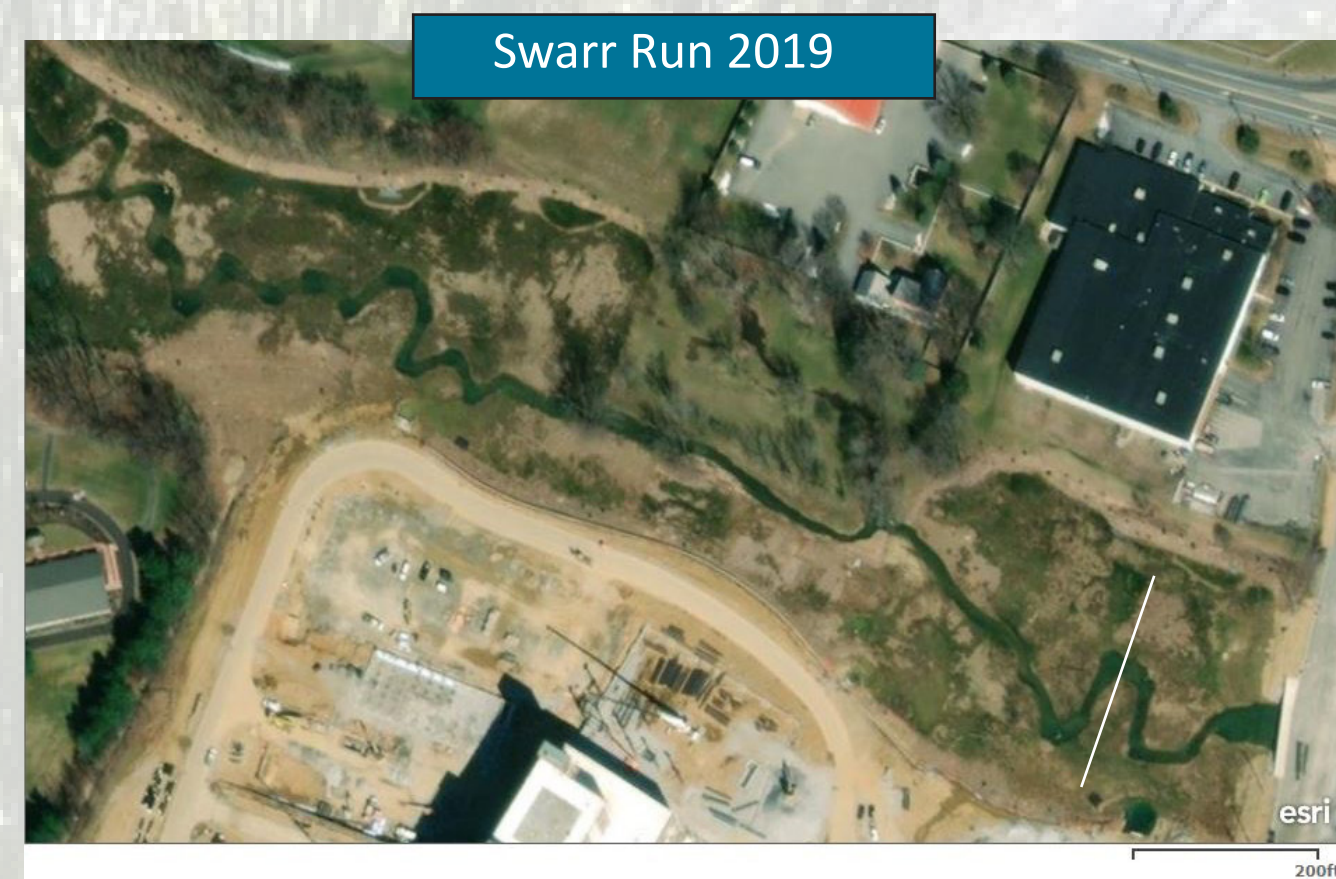
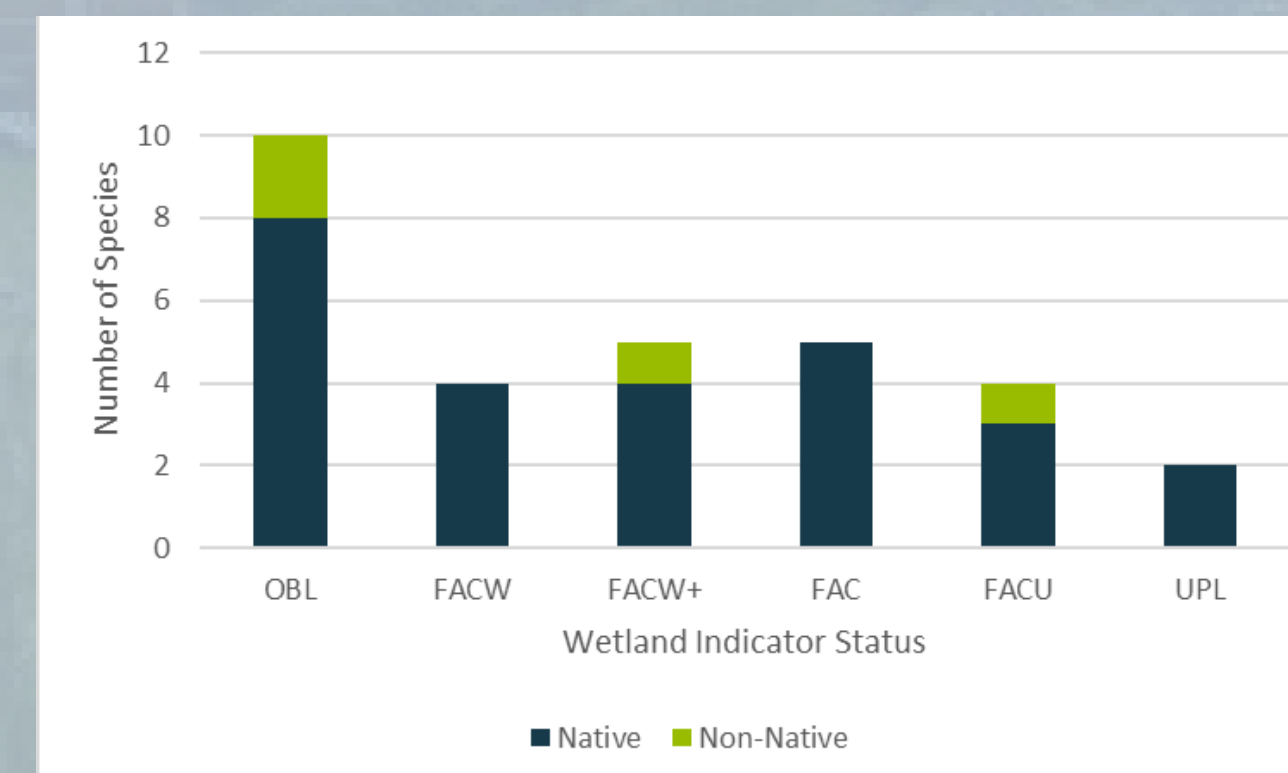
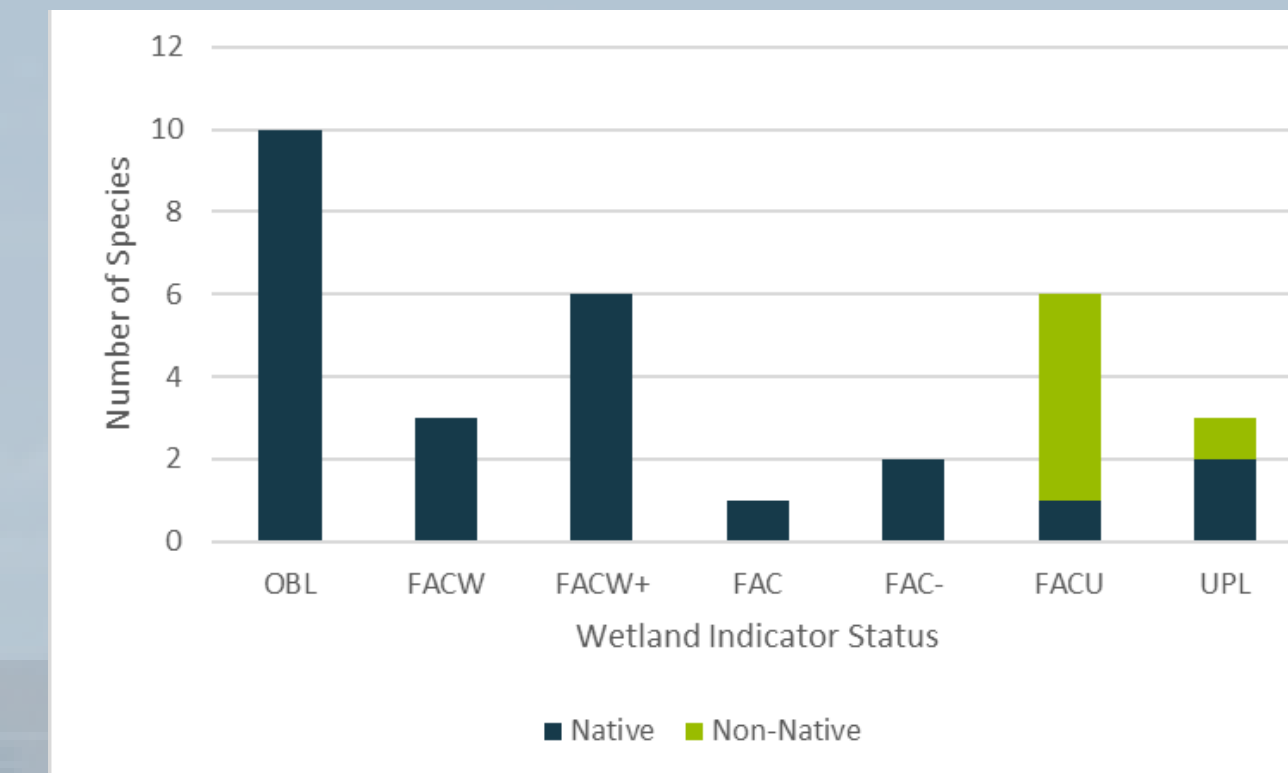
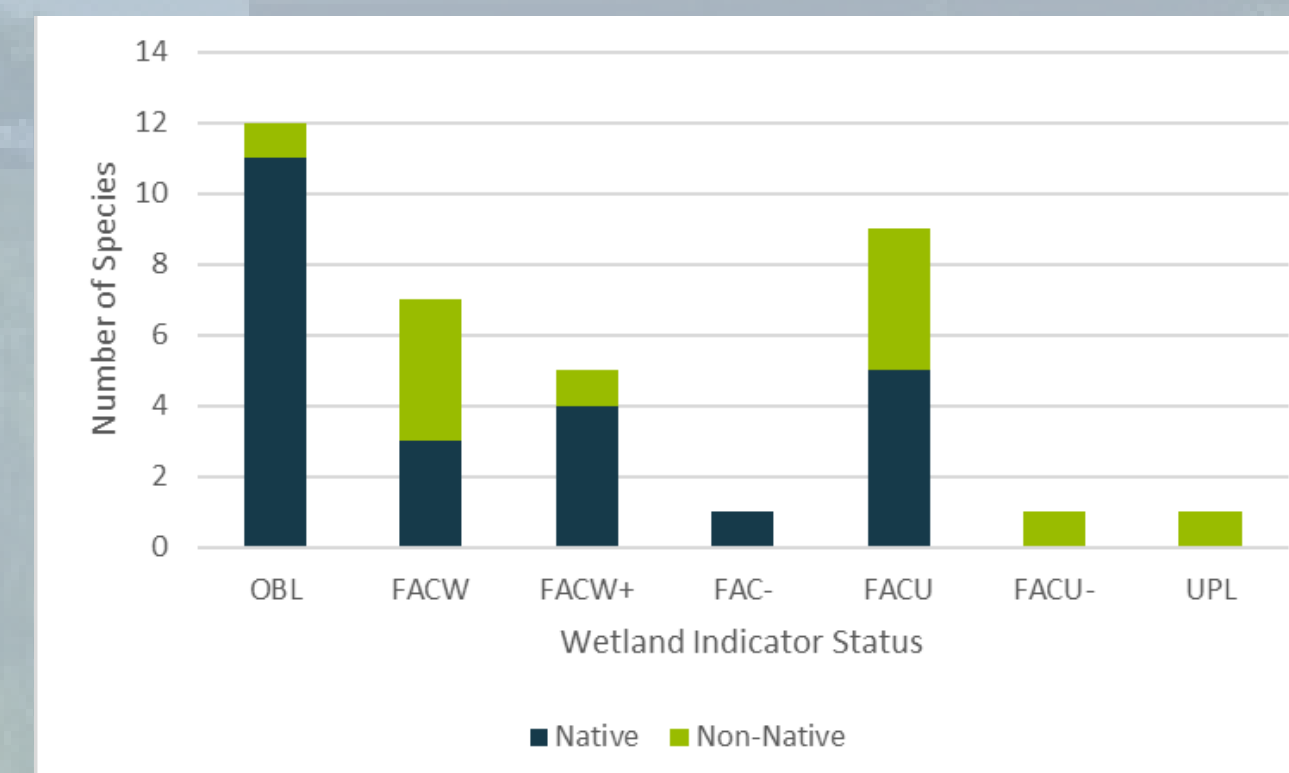


Figure 2. The maps of each of the three sites tested along with the year of their restoration. The white line indicates the general area of our randomly selected transects.

Results Vegetation

Code	Indicator Status	Description
OBL	Obligate wetland species	Almost always occurs in wetlands
FACW/Facultative wetland species	Usually occurs in wetlands	
FAC	Facultative species	Occurs in wetlands and non-wetlands
FACU	Facultative upland species	Usually occurs in non-wetlands
UPL	Upland	Almost always occurs in non-wetlands

(+): a frequency toward the wetter end of the category
 (-): a frequency toward the drier end of the category



- We tentatively identified several threatened, endangered or candidates for listing in Pennsylvania; more confirmation is needed⁴.

Figure 4. The total number of species present in wetland areas at Big Spring Run (top right), Brubaker Run (left) and Swarr Run (bottom right), utilizing the species wetland indicator status as well as their native or non-native status to highlight the difference in species type.

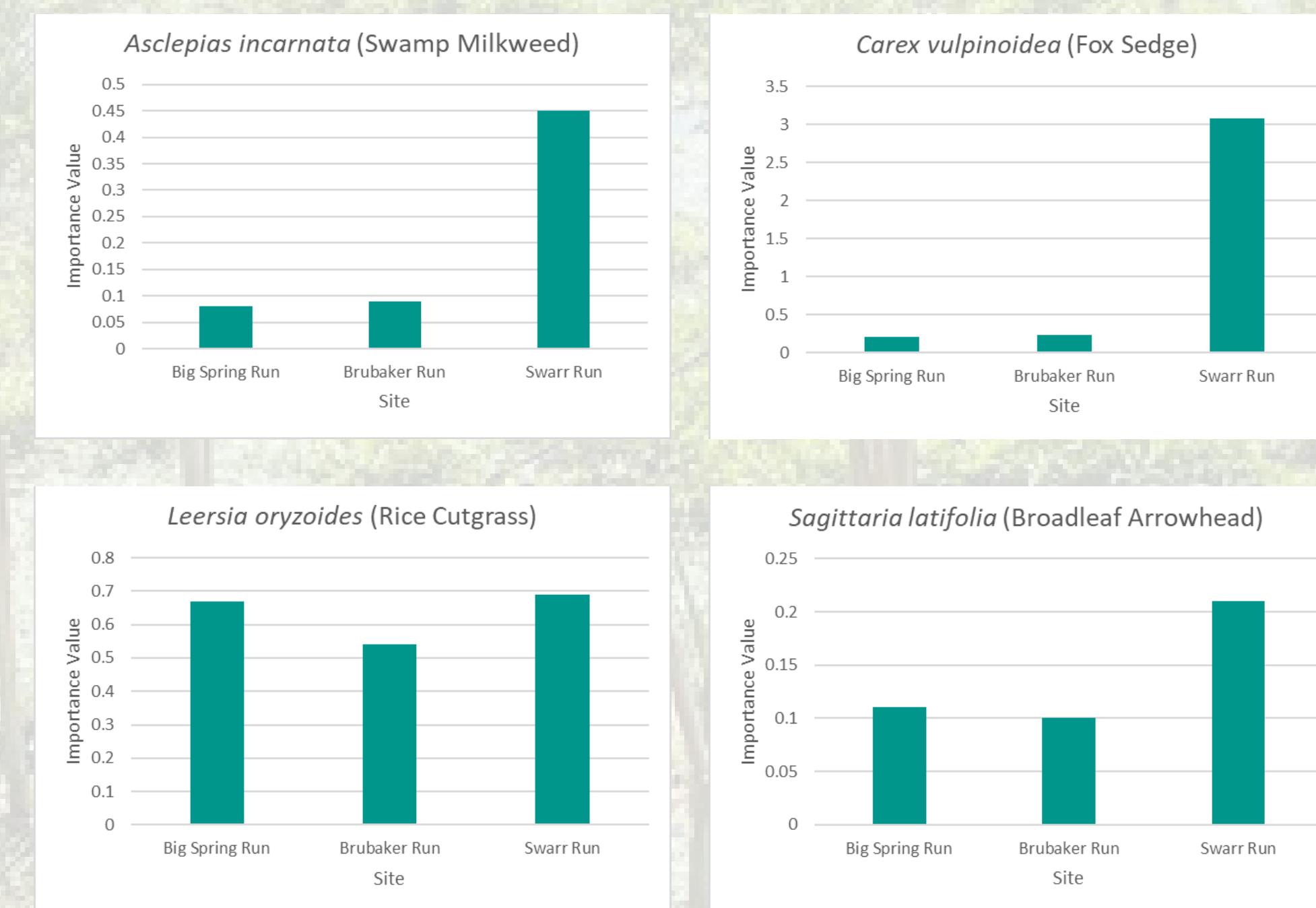


Figure 5. Shows the importance value for the four obligate wetland species found at each of the three sites.

Amphibians

- There was no effort to estimate the population size of *Eurycea bislineata* (Two-Lined Salamanders) and instead were reported as the number of salamanders per dip.
- Presence was confirmed by either sight, or hearing the calls for *Lithobates clamitans* (Green Frog) and capture for *Eurycea bislineata*. A lack of finding and/or capture does not mean the species are not present at the site.

Table 1. Shows the presence (1) or absence (0) of three species of amphibians, *Eurycea bislineata* (Two-lined Salamander), *Lithobates clamitans* (Green Frog) and *Anaxyrus americanus* (American Toad).

Species	Big Spring Run: Main	Big Spring Run: West	Brubaker Run	Swarr Run
<i>Lithobates clamitans</i> (Adults)	1	1	1	1
<i>Lithobates clamitans</i> (Tadpoles)	1	1	1	0
<i>Eurycea bislineata</i>	1	1	0	1
<i>Anaxyrus americanus</i>	0	0	1	0

Table 2. The calculated effort between the number of dips performed and the amount of *Eurycea bislineata* (Two-lined Salamander) caught at each site.

Site	<i>Eurycea bislineata</i> /dip
Big Spring Run: Main	0.125
Big Spring Run: West	0.017
Brubaker Run	0.000
Swarr Run	0.008



Figure 6. A larval *Eurycea bislineata* (Two-lined Salamander).

Discussion

- Various obligate wetland species were identified in each site, with *Asclepias incarnata* (Swamp Milkweed), *Carex vulpinoidea* (Fox Sedge), *Leersia oryzoides* (Rice Cutgrass), and *Sagittaria latifolia* (Broadleaf Arrowhead) being found in all three. These species are indicators of wetland habitat.
- Big Spring Run had a higher abundance of amphibian activity, notably with salamanders. This may relate to its restoration in 2011, as it had a longer period of time for species to arrive compared to the other sites.



Figure 7. A wetland area at Swarr Run (left) and Brubaker Run (right).

- With the fluctuating water levels due to flooding events, these wetlands create various temporary depressions of still water. These temporary depressions are essential for various species, including anurans, specifically *Lithobates clamitans* (Green Frog) and *Anaxyrus americanus* (American Toad)⁶.
- The amphibian and plant species we found at these three sites are indicative of the success of these restored floodplains.

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Figure 8. A *Lithobates clamitans* (Green Frog) tadpole with legs.

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