LARGE WOODY DEBRIS: INFLUENCE ON WATER QUALITY & BANK VEGETATION IN THE POMPERAUG RIVER

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ABSTRACT

Large woody debris (LWD) is a management technique used to restore rivers that have been channelized for agriculture. Channelization alters many physical aspects of rivers, resulting in increased erosion, loss of habitat (and consequently biodiversity), among others. In 2014, the Bent of the River Audubon Center (BOTR), installed 10 LWD in the Pomperaug River in Southbury, CT. The BOTR has been monitoring the river quality by conducting physical trait and chemical analysis, tests for common pollutants, and electroshocking fish surveys.

Working with BOTR, I evaluated the impacts of LWD sites on bank vegetation by quantifying the proportion of native species versus invasive species. I also assessed water quality (i.e. pH, ammonia, chloride, nitrate, sulfate, macroinvertebrate bioindicators) at a LWD site and compared it to a channelized section of the river.

One major finding was that invasive plant species were prominent along the riverbanks near the LWD sites. This could be due to increased wildlife using the LWD sites and increasing the spread of seeds of invasive plants. Another major finding was that ion concentrations were not too different between the LWD site and the channelized site, but macroinvertebrate diversity showed major differences. Although the actual chemistry between the two sites did not vary much, increased biodiversity and presence of pollution-sensitive aquatic insects at LWD sites demonstrates their importance in promoting an intact ecosystem that allows more life.

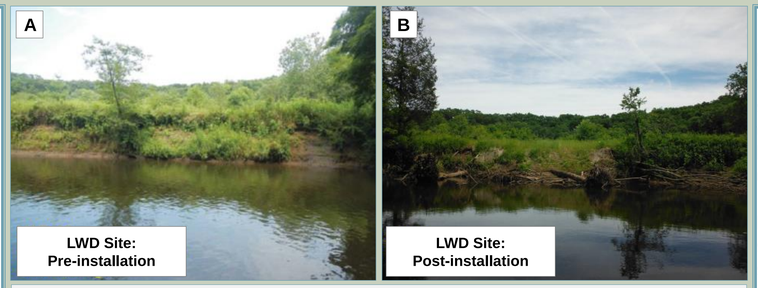


Fig. 1: The study site (A) before the large woody debris (LWD) installation—which was selected because it was a channelized river with eroding banks—and (B) after the LWD installation.

OUR GOAL

Investigate the effects of LWD installations on the surrounding terrestrial and freshwater ecosystem by:

1. Conducting invasive/native plant surveys on banks adjacent to LWD sites.
2. Evaluating water quality (i.e. water chemistry tests and macroinvertebrate surveys) between a LWD site and a flat channel site.

INTRODUCTION

Many rivers in Connecticut (CT) have been channelized for agricultural purposes (1), and the Pomperaug River in Southbury, CT, is no exception (Fig 1A). This results in loss of structural complexity in the river, increased erosion from water flow, and increased water temperature due to lack of shade and lower water levels (2), all of which impacts biodiversity. In addition, pollutants may concentrate due to the lack of riffles, which ultimately poses a threat to the health of freshwater life (1).

In 2014, the Bent of the River Audubon Center (BOTR) installed 10 large woody debris (LWD) sites in the Pomperaug River (Fig 1B). LWD sites consist of large trees including root systems which are anchored into the ground. The goal of the installation was to change streamflow promoting deep pools, circulating cold ground water, creating habitat and acting as flood control.

Although BOTR has been monitoring the effects of LWD on the stream ecosystem since 2014, changes in (1) riverbank vegetation and (2) water quality are two aspects that have not been studied as much. My project focused on these two aspects because (1) although LWD is a management tool meant to promote freshwater ecosystems, these structures may promote use by wildlife, which may impact the surrounding plant community; and (2) water quality is an essential indicator of the effectiveness of LWD management as water chemistry impacts all organisms that rely on freshwater systems.

RIVERBANK VEGETATION & INVASIVE PLANT REMOVAL

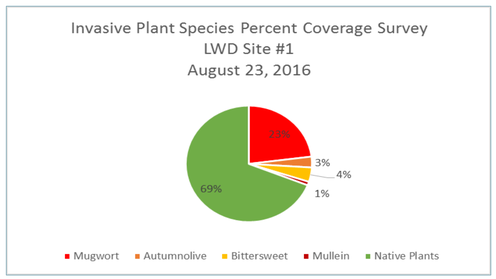
Method

I estimated percent coverage of invasive and native plants around two LWD sites:

- Set up 15 ft. x 15 ft. plot on the bank directly next to each LWD site.
- Used Terry and Chilingar (1955) Vegetation Percent Coverage Chart to determine percent cover of each invasive plant species as well as for native plants collectively.

Results

- Plant surveys revealed a significant proportion of the bank was occupied by invasive species near LWD sites (Fig. 2).
- Both sites had a prevalence of mugwort.



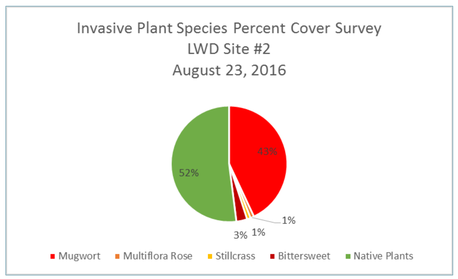


Fig. 2: Percent cover of each invasive plant species and native plants collectively within 15'x15' plots next to two LWD sites. At both sites 4 invasive species were observed and occupied 30-48% of the plot.

Invasive Plant Removal

- Given the significant prevalence of invasive plants near LWD sites, I organized a removal party on 23 October 2016 (Fig. 3).
- A mechanical removal approach was employed, as it causes the least amount of distress for the surrounding habitat.

Fig. 3: Photos to the right show the removal of invasive plant species around LWD sites. We dug up/hand pulled mugwort, mullien, and autumn olive, and clipped purple loosestrife (not included in plot results above) off of the stump of one of the LWD sites.

WATER QUALITY OF LWD & CHANNELIZED SITES

Method

Water quality was assessed at one LWD site and one channelized site using multiple methods:

- Test strips for pH and ammonia
- Chromatography testing in a local chemistry lab for chloride, nitrate, and sulfate
- Macroinvertebrate (e.g. aquatic insect) surveys using a net, bucket, and guide table (Fig. 4)

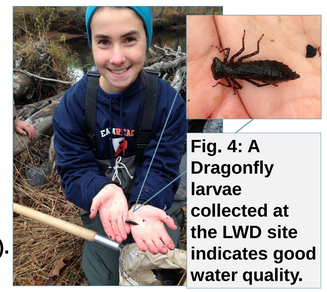


Fig. 4: A Dragonfly larvae collected at the LWD site indicates good water quality.

Results

- Little difference in ion concentration or pH between LWD and channelized sites (Fig. 5A-E).
- Higher chloride levels were found at the earlier testing date due to the road salting.
- Higher biodiversity of macroinvertebrates at the LWD site than the channelized site (Fig. 5F).

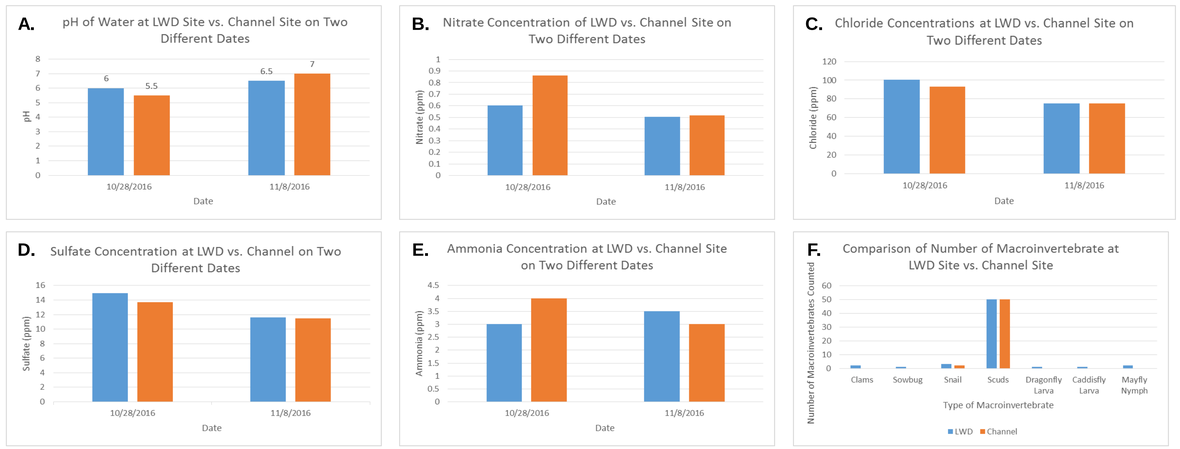


Fig. 5: Differences in (A) pH, (B) nitrate, (C) chloride, (D) sulfate, (E) ammonia, and (F) macroinvertebrates between the LWD (blue) and channel (orange) sites.

CONCLUSIONS

- Our vegetation plot surveys indicated that there was a noticeable increase in invasives at the LWD site. This suggests a higher amount of usage by wildlife; however the abundance of life introduces the potential of spreading more invasives. This occurrence means that there will be a constant management of invasives within the LWD sites.
- Although no significant difference in water chemistry was observed between the LWD and channelize sites, diversity of macroinvertebrates revealed that the LWD are encouraging more species to inhabit the area, which greatly improves the life cycle and creates opportunities for even more species to live there.
- Overall, the LWD sites are fulfilling their intended purpose of improving life and habitat in the Pomperaug River in Southbury, CT.

ACKNOWLEDGEMENTS

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(1) DEEP. *Stream Habitat Restoration Projects.* October 27, 2007.

(2) DEEP. *Restoring the Pomperaug River with Woody Debris*. Ecosystem Management and Habitat Restoration Grants, Audubon Center Bent of the River.