INTRODUCTION

- The resilience to disturbance events, like flooding, need to be better described in highly-altered river systems to maximize conservation delivery and restoration (Tockner and Stanford 2001, Ward et al. 2001).
- The floodplain-river connection is a defining characteristic in river systems where flood magnitude, duration, and timing produce effects that are critical to these systems (Opperman et al. 2010).
- The task of restoring lakes in an altered floodplain is complicated when the area is disturbed by floods, yet paradoxically, floods are part of the dynamics.
- Given flooding in a river flood-pulse system is both part of the ecology and yet a disturbance to restoration, the primary goal of this work was to explore how floodplain lakes in areas undergoing ecological restoration respond to flooding.

OBJECTIVES

To compare trends in water quality measurements in Illinois River floodplain shallow lakes that varied in:
- the degree of flooding (i.e., disturbance)
- the extent of restoration

MATERIALS AND METHODS

- This study represents an exploration of several studies that took place on floodplain lakes with a range of restoration ecology efforts in or by the LaGrange reach of Illinois River from 2003 until present.
- Field Measurements - Water quality measurements (n=3) were made on-site bi-weekly at Thompson Lake (Emiquon Preserve, Fulton Co.) and Long Lake (Merwin Preserve, Brown Co.) and at 45 day intervals at Big Lake (IDOT Brown County) for water depth (measuring stick), Secchi depth (m) and turbidity (2100P turbidimeter, Hach, Loveland CO).
- Laboratory Measurements - Samples of top water (n=3, 6 cm depth) were processed for total suspended solids, ash-free dry mass, total nitrogen (APHA 1998), nitrate and soluble reactive phosphate (Dionex ICS-2100 ion chromatograph), and chlorophyll-a (Wetzel and Likens 2001; Cary Bio 100 spectrophotometer).
- Samples were analyzed by affiliates at both Therkildsen Field Station at Emiquon University of Illinois Springfield.

ACKNOWLEDGEMENTS

We thank Illinois Department of Transportation, National Science Foundation (DEB-1347077), and the University of Illinois Springfield for funding. The Nature Conservancy for access to Emiquon and Merwin Preserves, and field, lab and collaborative assistance from many and in particular, J. Bartletti, C. Buchman, A. Grant, T. Grode, D. Kratohvil, D. Jenkins, and K. D. Blodgett. and David Jenkins provided photos; the US GIS lab produced the map.

DISCUSSION

- Flooding: The effect of flooding on these lakes increased nutrients (NO₃⁻, SRP, NH₄⁺) 3-4 times and caused total suspended solids and chl a to increase 10 fold (p < 0.05).
- Restoration: Compared to the flooded, non-restored reference study site, floodplain lakes under restoration had 3-5 times less nutrients (NO₃⁻, SRP, NH₄⁺) but showed no significant difference in suspended solids or chl a.
  - Low nitrate and SRP concentrations in the post-flood and recovery stages indicated that the nitrate was rapidly processed, likely through denitrification.
  - TSS was low at all sites but had minor increases in the post flood stage with notable high increases in the recovery stages at flooded sites regardless of restored state (LL13 and BL02) likely due to the algal blooms (confirmed with percent ash-free dry mass analysis).
  - Only the restored, not flooded site (LL02) had no ammonia change.
  - Algal biomass (i.e., autochthonous primary production; Chl-a) increased after flooding and showed the greatest increase in the non-restored, flooded (BL02) lake. Similarly, Weigelhofer et al. (2015) reported that nutrients from Danube River flooding raised primary productivity (i.e., rate of primary production) in adjoining floodplain lakes.

CONCLUSION

- Extensive flooding increases nutrient loading that results in algal growth as the system recovers.
- While lakes under restoration show less overall effect from floods, it does not mean they are unaffected.
- Other measures revealed little difference among stages in the pattern of response to flooding for non-restored and restored lakes.
- River connection extends a greater influence on the biotic response of these shallow lakes than is the state of their restoration.

REFERENCES


