Wetland monitoring of the bottomland hardwood forest at the Olentangy River Wetland Research Park (Year 3 - 2003)

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by

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Introduction

This report represents the third-year mitigation report for the project "*Wetland Monitoring and Management Plan for Off-Site Wetland Mitigation for Spring-Sandusky Interchange*" contracted between The Ohio State University and the Ohio Department of Transportation. It represents the third-year monitoring of the restoration of a 13-acre bottomland forest, carried out as part of the mitigation for the Spring-Sandusky interchange project in downtown Columbus. The bottomland hardwood forest is part of the 30-acre Olentangy River Wetland Research Park at The Ohio State University (Fig. 1). This report covers the period from January 1 - October 31, 2003.

Site Restoration

Restoration/enhancement of this 13-acre bottomland forest involves two major management approaches:

Hydrologic restoration

Four 20 ft wide breeches were made in an artificial levee that runs most of the northern half length of the bottomland forest. The levee had been constructed to prevent floodwater from reaching the floodplain perhaps as long as 100 years ago. In June 2000 and again in April 2001, the levee was breached in 4 locations to allow floodwater to enter the site. Locations of levee cuts are shown in Fig. 2. Restored hydrology is expected to result in increased productivity of canopy trees in the forest in the long term and may result in some species shifts in the short term to more flood-tolerant species. The increased flooding is also expected to bring in nutrients and plant propagules, both of which will lead to enhanced forest productivity and biodiversity.

Removal of alien honeysuckle

Volunteer groups, in collaboration with the ORWRP, ODOT, and the City of Columbus, continued to remove the alien Amur honeysuckle (*Lonicera maackii* Maxim.) in 2003 as a second part of the restoration. The removal of honeysuckle is expected to allow the bottomland subcanopy to become more diverse as its dense biomass is removed.

Aerial Photographs for 2003

Aerial photography of the bottomland forest is obtained twice per year by ODOT aircraft (forest with canopy leaves down in winter and peak biomass in August). Photos for January 8, 2003 and August 18, 2003 are shown in Figures 3 and 4 respectively.

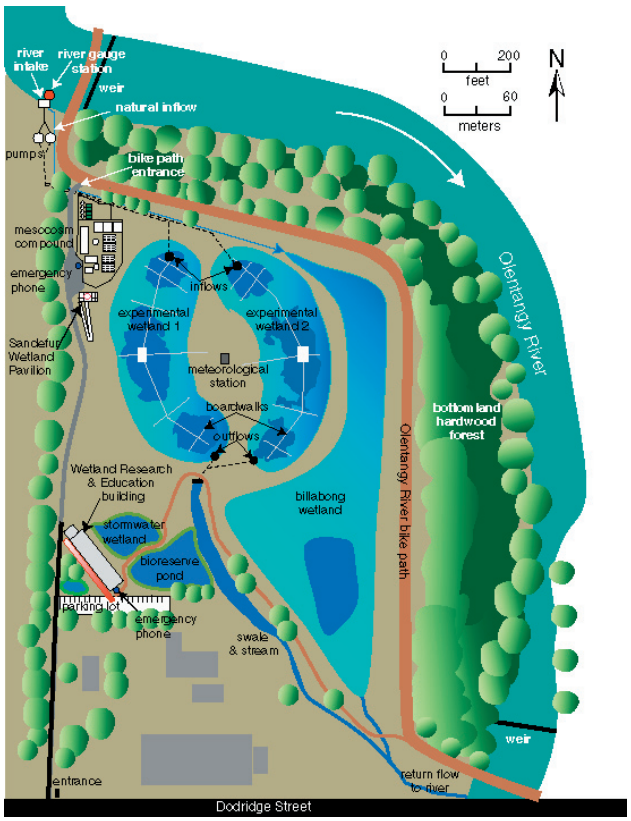

Figure 1. Master map for the Olentangy River Wetland Research Park at The Ohio State University. The bottomland hardwood forest is shown along the northern and eastern edges of the research park.

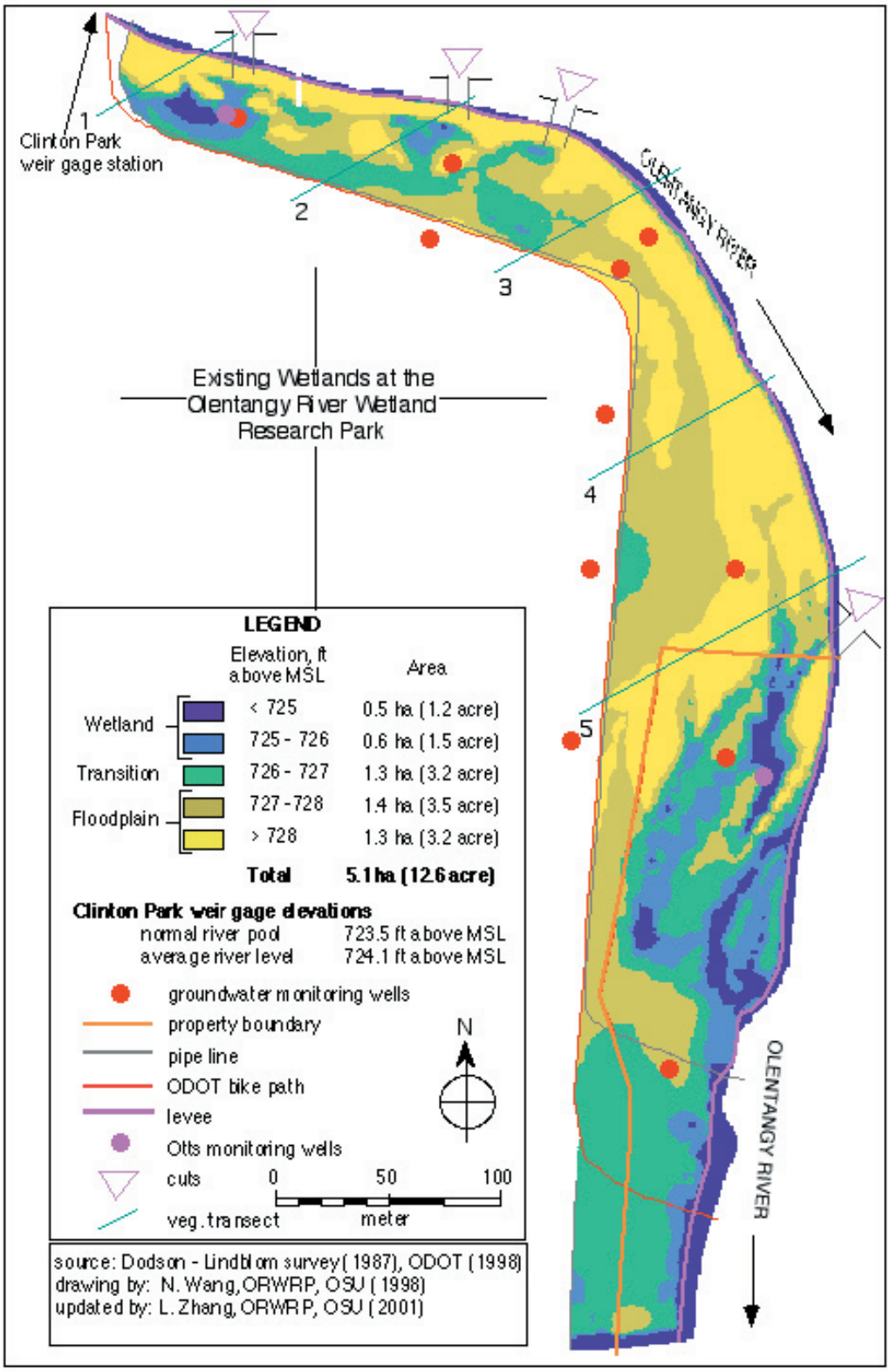

Figure 2. The 13-acre bottomland forest monitoring area, indicating land elevations, monitoring wells, and 4 locations ("cuts") where artificial levee was breached to allow bottomland flooding.

Figure 3. Aerial photo of enire site on January 8, 2003, about 31 months after levees were cut.

Figure 4. Aerial photo in August 18, 2003, for bottomland forest and Olentangy River Wetland Research Park. This is approximately 38 months after cuts were made in levee. Vegetation shows no permanent scars in forest canopy from the cuts.

Table 1. Dates of honeysuckle harvesting in the bottomland hardwood forest at the Olentangy River Wetland Research Park in 2003

Date	Group	Location of activity	Herbicide?	Est. man-hrs
April 12, 2003	OSU/ORWRP Planting Day	northern one-fifth	yes	100
September 23, 2003	FLOW/OSU volunteer group	northern one-third	yes	60
October 11, 2003	FLOW volunteer group	northern one-third	yes	60

Figure 5. Photos taken on April 12, 2003, showing removal of alien honeysuckle plant material from bottomland hardwood forest by Ohio State University, FLOW, and ODOT volunteers, during ORWRP “Planting Day.”

Table 2. Floods of bottomland hardwood forest since beginning of the mitigation monitoring of this bottomland hardwood forest in January 2001.

Date	Peak river stage, ft
April 11, 2001	16.15
December 2, 2001	16.74
December 18, 2001	17.87
February 3, 2002	16.91
April 5, 2002	16.88
April 14-18, 2002	17.88
May 17, 2002	16.99
March 5-14, 2003	16.85
April 8, 2003	16.61
May 12-16,2003	18.22
June 14, 2003	17.77
July 13, 2003	16.23
August 30,2003	16.93
September 30, 2003	17.08
Decemebr 1, 2003	16.89

The winter photograph of January 8, 2003 (Fig. 3) illustrates the forest floor without canopy vegetation blocking the view. No scours or excessive destabilization of the floodplain are seen as a result of the flooding. The photo illustrates some ponding, as expected, at the northern part of the bottomland hardwood forest and at internal channels in the southern third of the bottomland forest. This corresponds well with the contours measured before the restoration began as shown in Fig. 2. Thicker "cover" is seen in the January photo in the lower third of the bottomland western border. This is the open boundary with the bikepath where extensive honeysuckle remains. The areas to the north, where honeysuckle has been removed, shows a more opened groundcover.

The levee cuts shows no obvious effect on canopy structure in the August 2003 aerial photograph (Fig. 4) and the canopy appears to be 100% cover and in good health in the growing season.

Honeysuckle management in 2003

A summary of alien Amur honeysuckle (*Lonicera maackii* Maxim.) removal events at the bottomland hardwood forest since these efforts began is given in Table 1. There were 3 events in 2003 where volunteers were mobilized to remove the alien species from the forest understory. About 50 volunteers removed honeysuckle aboveground biomass as part of a restoration of portions of northwestern corner of the ORWRP bottomland forest on a Wetland Planting event cosponsored by Battelle on April 12 (Fig. 5). This event was cosponsored by Friends of Lower Olentangy Watershed (FLOW), the Ohio Department of Transportation (ODOT), and the City of Columbus. A second honeysuckle harvest with about 30 OSU volunteers on September 23, 2003 with OSU volunteers mobilized by FLOW. All harvesting to date has occurred in the northern one-third of the bottomland hardwood forest, approximately to the curve in the river. It is estimated that about 4 acres of the bottomland forest have had a second or third honeysuckle harvesting to date. Studies in 2003 (attached and summarized below) suggest that honeysuckle removal is beginning to have a positive effect on subcanopy vegetation. The city of Columbus applied herbicides on plant stumps (well away from volunteers) during the plant clearings.

Hydrology

A stream gauging station with an Ott Thalimedes data logger and water quality probe was installed on the Olentangy River in June 2001 and a 30-min interval reading was established for downloading data (see "Clinton Park weir gage station in Fig. 2). Two water level stations with Ott Thalimedes data loggers were installed at upstream and downstream sites in the bottomland forest in December 2000 (see "Ott monitoring wells" in Fig. 2) with 30-min interval readings. Recording started February 2001. One Ott recorder is located near the 1st cut in the levee and is referred to as "upstream" site. The 2nd Ott is located downstream of the 4th and last cut and is referred to as the "downstream" site. A third water level recorder is on the Olentangy River itself at the northwestern corner of the bottomland forest (see Clinton Park weir gage station in Figs. 1 and 2).

Eight major independent flooding events occurred into the bottomland hardwood forest in 2003 with sufficient stage to flood the bottomland forest through the cut notches (Table 2 and Figure 6). In the three years of monitoring the river since the cuts were made in the levee, 15 flooding events have occurred in 3 years, yielding an average of 5 floods per year. This is the rate than that was predicted when the mitigation was designed in 1998-99. Water level records for periods of available data from the upstream groundwater recorder in the bottomland forest are shown in Figure 7. Substantial flooding of Olentangy River water occurred in the bottomland forest as a result of the cut notches. The downstream water level data logger was harmed by a particularly high river flood in early 2003 or late 2002. Both water level recorders were reinstalled in fall 2003 to elevations well above any expected flood to avoid future injury to instrumentation.

Water quality

Figure 8 and 9 show river stage and water quality in the Olentangy River during flooding events in April and early June 2003. Flooding causes dramatic increases in turbidity and decreases dissolved materials (see conductivity). Peaks in turbidity often precede the flooding of the bottomlands as well as occurring during the bottomland flooding. Turbidity in the river indicates significant sediment loads which in turn transport substantial amounts of nutrients, particularly phosphorus, into the bottomland forest. This increased nutrient input will lead to enhanced forest productivity.

Vegetation

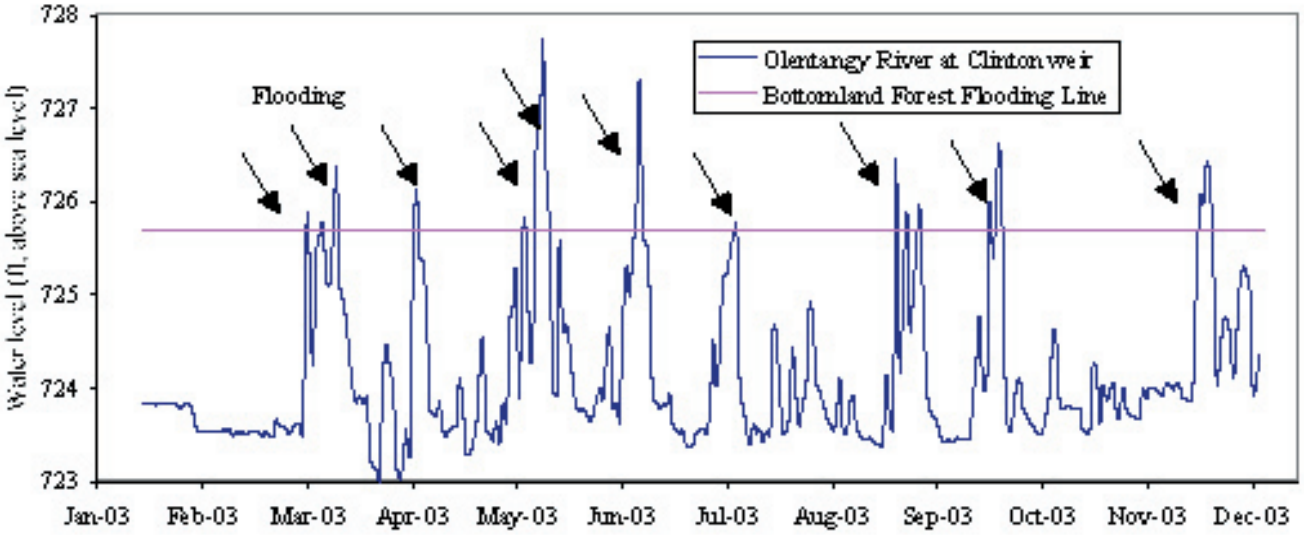

Figure 6. Hydroperiod for Olentangy River at ORWRP for 2003. Arrows indicate 10 flood peaks (8 independent floods) that occurred in 2003 in the bottomland hardwood forest. Flooding line indicates approximate level at which river stage floods bottomland.

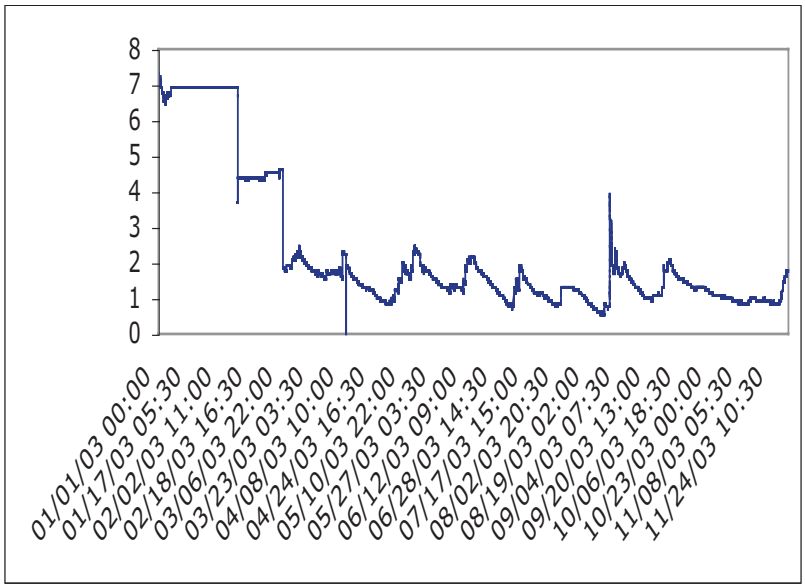

Figure 7. Upstream groundwater monitoring well in bottomland hardwood forest, January to November, 2003. Water level peaks correspond to water level peaks in river staff gage.

Canopy

Forest canopy vegetation was not monitored by formal survey in 2003 as the survey in 2001 still reflects canopy vegetation and no changes have been observed. Tree species with the highest relative densities were box elder (*Acer negundo*), Ohio buckeye (*Aesculus glabra*) and Eastern cottonwood (*Populus deltoides*). Most of the tree species (12 out of 16) are facultative (FAC) and drier. We continue to believe that in the long run (>50 years) the canopy will change to reflect wetter conditions as a result of the hydrologic restoration. Aerial photography from August 2003 (Fig. 4) show a healthy canopy with no canopy gaps and essentially 100% cover.

Understory

In October 2003, two detailed studies were undertaken to determine the combined effects of Amur honeysuckle (*Lonicera maackii*) harvesting and increased flooding on understory vegetation and soil moisture. (See attached reports) The first study (Gill and Mitsch, 2003) indicates that there appeared to be less honeysuckle (11% cover) in the harvested areas compared to 50% cover in the control non-harvested areas. There was also a greater understory plant diversity in 2003 where honeysuckle was removed. Groundcover effects were mixed. Virginia creeper increased in sites where honeysuckle was removed but garlic mustard decreased where it was removed. Overall groundcover

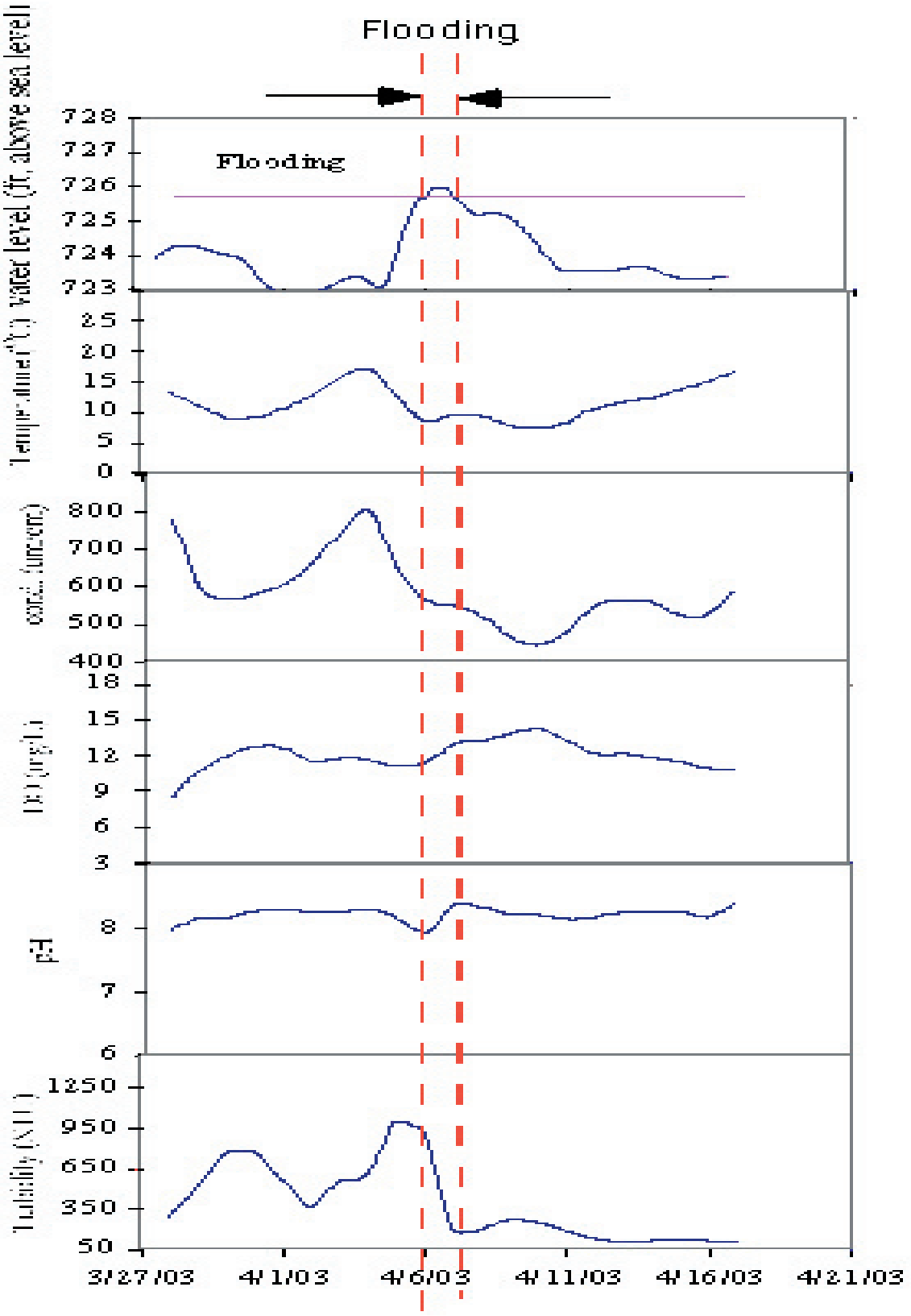

Figure 8. River stage and water quality of Olentangy River before, during, and after bottomland flooding of April 2003.

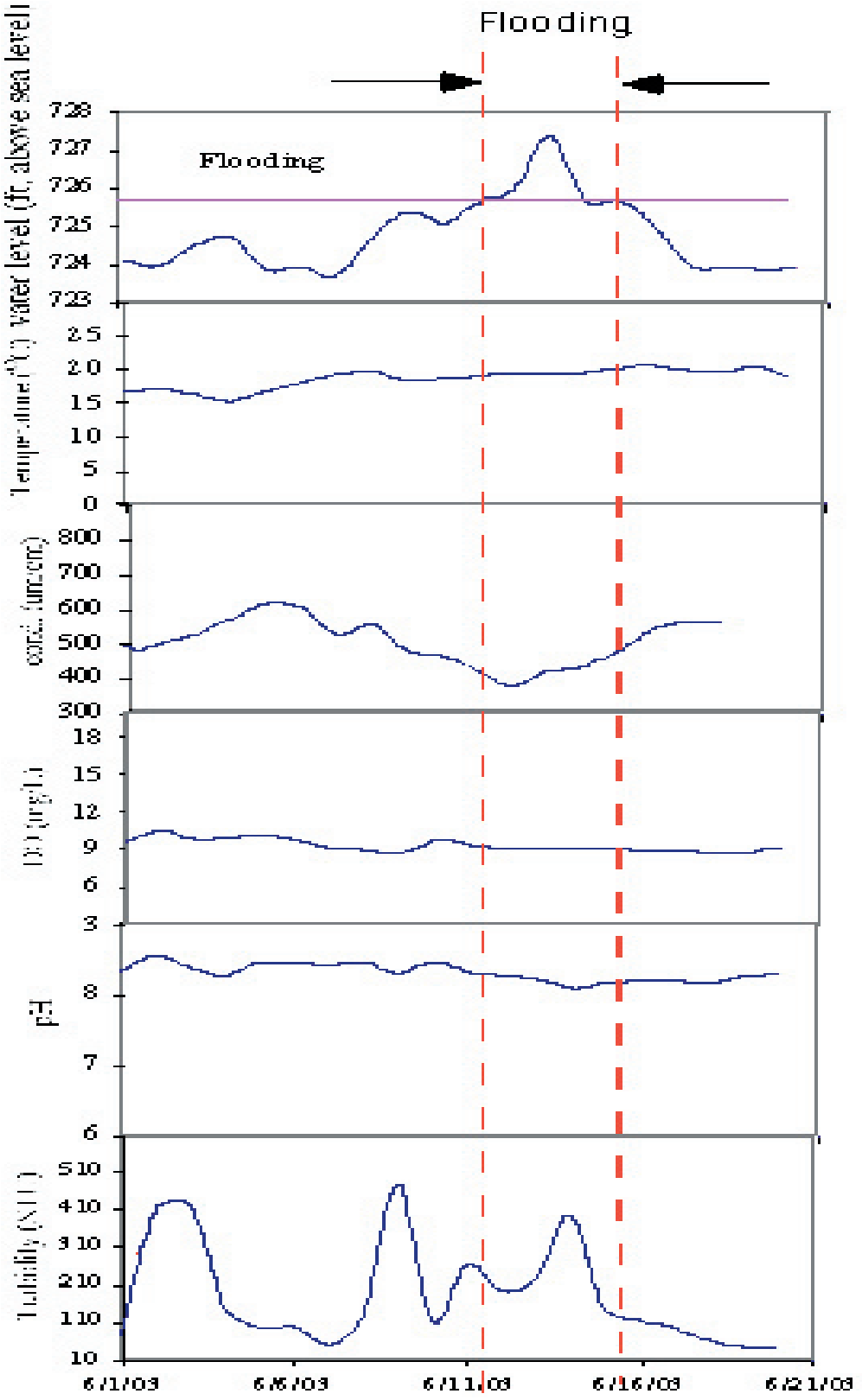

Figure 9. River stage and water quality of Olentangy River before, during, and after bottomland flooding of June 2003.

increased 8.8% and woody species increased by 15% in cover in areas where honeysuckle was removed. This study concluded that continued aggressive *L. maackii* removal will be necessary to ensure a diverse understory community in the bottomland hardwood forest. The second study (Swab et al., 2003) suggests that honeysuckle survives better at higher elevations (drier locations) than in lower (wetter) elevations in areas that had not yet been subjected to plant harvesting. There was an average of 2 honeysuckle plants per square meter in sites that were designated as "upland" sites (>727 ft MSL) while there were only 0.3 plants per square meter at lowland sites (<727 ft MSL). That study suggests that the increased flooding due to the levee breeching will ultimately have a positive effect on the removal of honeysuckle from the forest that will complement the plant harvesting. It also suggests that harvesting efforts could be concentrated in areas higher than 727 ft in this bottomland forest.

References

Gill, D.P. and W.J. Mitsch. 2003. Response of the invasive shrub, *Lonicera maackii* (Rupr.), to removal efforts in a bottomland hardwood forest of central Ohio. (this report)

Swab, R., K. Simmons, S. Boone, and W.J. Mitsch. 2003. Correlation between honeysuckle abundance and elevation. (this report)