# Project Status
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Upper Mississippi River
Long Term Resource Monitoring Program
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# Forest Response to High Duration and Intensity Flooding along Pool 26 of the Upper Mississippi River

by

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Many natural resource managers could not anticipate the effects that the flood of 1993 would have on floodplain forests of the Upper Mississippi River. Previous experience suggested that floodplain forests were adapted to such events and should only experience removal of upland and non-native species. However, when trees considered highly flood tolerant did not leaf out in the spring of 1994, natural resource managers began to realize the serious impact that a large-scale flood could have on floodplain forest communities. To better understand these impacts, researchers with the Long Term Resource Monitoring Program at Pool 26 of the Upper Mississippi River System (UMRS) began describing forest community response to the large-scale flood of 1993.

The floodplain forests of the UMRS are some of the most productive ecosystems worldwide. These communities provide habitat and forage for many species of wildlife, produce timber, and provide a valuable carbon dioxide sink. Like many other plant communities, floodplain forest successional patterns are largely driven by disturbance events (e.g., fire, wind-throw, flooding, drought, and physical erosion/deposition). Black willow and eastern cottonwood regenerate on recent deposits of substrate (mainly sand) created by the river. As a result of annual floods, fine sediment drops out of suspension and the low landform occupied by the willow/cottonwood community develops into a low terrace. At the same time, the willow/cottonwood community is gradually being replaced by silver maple and green ash. The process of terrace building continues and communities of mixed forests and oak forests develop as elevation increases and the frequency of flooding decreases. Understanding how these communities respond to the various disturbance events, particularly large scale flooding, is important to natural resource managers who are trying to manage for specific or diverse floodplain forest communities.

Flooding is the most common disturbance event on a floodplain, occurring almost annually at lower elevations. The effect of flooding on floodplain forests is not homogeneous and is largely dependent upon flood frequency, duration, intensity, timing, and stage of successional development. Most floodplain trees are adapted to survive moderate floods, however, tree species are considered susceptible to high duration and intensity flooding events, especially when these events occur during the growing season. Questions regarding forest community response following high duration and intensity events have arisen.

The flood of 1993 provided an opportunity to document floodplain forest response to a high intensity, long duration (195 days) flood that occurred during the growing season. We quantified the percent

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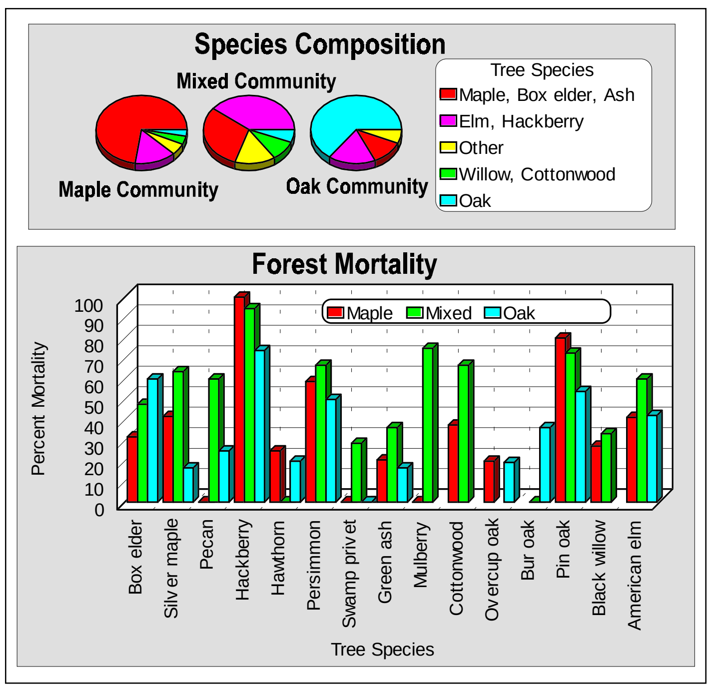


**Figure 1. Percent mortality of maple, mixed, and oak forests along Pool 26 of the Upper Mississippi River System following the flood of 1993.**

**Figure 2. Maple/ash forest community, Pool 26 of the Upper Mississippi River System, Spring 1995.**

mortality of three floodplain forest community types (maple, mixed, and oak) along Pool 26 near St. Louis, Missouri. Our results (Figure 1) indicate there was a community, species and size specific response to the flood event.

Oak and maple communities responded similarly with an overall tree mortality of 42% and 41%, respectively. Mixed communities exhibited a higher mortality (60%). Among all communities, the most negatively impacted tree species were hackberry (ranging from 74% to 100%) and pin oak (ranging from 54% to 80%). Saplings suffered a higher mortality rate than trees. Maple and mixed communities lost 80% of the saplings, while oak communities lost 56% of the saplings. All saplings seemed equally susceptible, however, common persimmon, swamp privet and green ash had better survivorship than most (average mortality of 36%, 57% and 48%, respectively).

Estimating forest successional patterns following any disturbance event is often difficult. To accurately predict community trend, sampling at more than one point in time is required. By examining the tree and sapling survivorship results, we can only suggest how forest communities might respond. We believe that oak sites may be set back to an earlier successional stage as silver maple, green ash trees, and green ash saplings had better survivorship on these sites. This prediction excludes sites dominated by overcup oak, because these sites had excellent survivorship (19% mortality) and were relatively unaffected by the flood disturbance. We could draw no conclusions about the mixed forest community. Even though swamp privet, hawthorn and persimmon had the best survivorship on these sites, they are considered understory trees and are generally not considered forest dominants. Although the maple sites suffered moderate mortality (example, Figure 2) in the dominant trees (42% for silver maple and 21% for green ash), there are a large number of dominant trees remaining and we believe that these sites will regenerate back to maple communities.

The high mortality of hard- and softmast producing species (e.g., pin oak and hackberry) across all forest communities will create problems for natural resource managers who are trying to promote wildlife, particularly game animals. Much of the floodplain forests of Pool 26 are currently managed for waterfowl, turkey and whitetail deer. These species rely heavily upon acorn production for forage during the fall and winter. The loss of pin oaks and oak forests in general may have a corresponding decrease in the ability of floodplain forests to support important game species as well as other wildlife.

We are currently trying to further predict forest successional trends using seedling regeneration data related to overstory canopy removal, location in regards to seed trees, soil properties, and herbaceous cover. We ultimately hope to resample the forest sites on Pool 26 and use the information in a model to better predict forest community trends following catastrophic flood events. ❐

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