

Predicting Flood Potential to Assist Reforestation for the Upper Mississippi River System

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Tree mortality along the Upper Mississippi River has been positively correlated with flood duration and amplitude. This mortality seems to be greatest in small trees. In fact, mortality of saplings was as high as 80% near St. Louis, Missouri, after flooding in 1993, with many areas experiencing 100% mortality of seedlings. In addition, numerous studies have shown that flood tolerance of trees is species specific. Thus, reforestation success at sites that have a high flood potential can be increased by planting taller seedlings or tree species that are more flood tolerant.

We developed flood potential models for the Upper Mississippi and lower Illinois Rivers to assist foresters in selecting sites, tree species, and tree sizes for successful reforestation. Model results are displayed as a series of tables, one for each river mile. Each table includes the percentage chance of flooding per year for a range of durations and elevations (feet above mean sea level). Percentage estimates were calculated for 3-day to 8-week periods and may include multiple flooding events within a single year. An example of a flood potential model for river mile 541 in Pool 13 is displayed in Table 1.

The model was based on daily water surface elevation data collected by the U.S. Army Corps of Engineers

Table 1. An example of results from the flood potential model for the Upper Mississippi River System as they are displayed at http://www.umesc.usgs.gov/data_library/water_elevation/flood_potential.html. Values in the table signify the annual percentage chance of flooding during a growing season. Elevations are in feet above mean sea level.

Pool 13, River mile = 541		Duration of flooding					
Elevation	3 days	1 week	2 weeks	4 weeks	6 weeks	8 weeks	
597	2	0	0	0	0	0	
596	2	2	0	0	0	0	
595	4	2	0	0	0	0	
594	7	4	2	0	0	0	
593	13	9	4	0	0	0	
592	16	13	4	0	0	0	
591	20	13	11	2	0	0	
590	27	24	13	4	2	0	
589	47	36	22	7	4	2	
588	64	58	40	16	7	4	
587	80	73	67	47	33	13	
586	91	87	84	67	51	44	
585	98	93	91	82	71	71	
584	100	100	100	100	96	91	
583	100	100	100	100	100	100	

from 1954 through 1998 for the estimated growing season. Estimated dates for the growing season were obtained from local foresters: April 30 to October 13 for Pools 2 through 10, April 15 to October 15 for Pools 11 through 22, and April 1 to November 1 for areas down river of Lock and Dam 22 and for the lower Illinois River. Water elevation gages that were missing more than 20 years worth of data were eliminated from analysis resulting in useful data from 133 gages (Table 2). Other missing data for these gages

were estimated. If a value was missing for only one day, it was estimated by interpolating between values from the day before and after at that gage. If values were missing for successive days, they were estimated with a second-order regression using data from a nearby gage. After the data sets were completed for the 133 gages, we used linear interpolation to estimate daily water elevations for river miles where no gage was present. Most gages are less than 20 miles apart with a maximum distance of 39 miles

Table 2. The location of river segments, river miles, the number of water elevation gages used for a segment, and the maximum distance between gages used in the flood potential model for the Upper Mississippi River System.

Location	River miles	Number of water elevation gages	Maximum distance between water elevation gages (miles)
<i>Mississippi River</i>			
Pool 2	816-847	4	18
Pool 3	798-815	3	14
Pool 4	753-796	5	18
Pool 5	739-752	3	10
Pool 5A	729-737	2	9
Pool 6	715-728	3	11
Pool 7	703-714	3	7
Pool 8	680-702	4	10
Pool 9	649-678	3	16
Pool 10	616-647	4	14
Pool 11	584-614	4	14
Pool 12	557-582	3	23
Pool 13	523-556	4	13
Pool 14	494-522	5	9
Pool 15	483-493	3	5
Pool 16	458-482	4	14
Pool 17	438-457	4	13
Pool 18	411-436	4	13
Pool 19	365-410	4	19
Pool 20	344-364	4	9
Pool 21	325-343	4	8
Pool 22	302-324	3	15
Pool 24	274-301	4	11
Pool 25	242-273	5	10
Melvin Price Pool	203-241	4	15
Open River	176-196	5	6
Open River	151-175	4	13
Open River	126-150	4	11
Open River	101-125	3	14
Open River	76-100	4	15
Open River	51-75	4	15
Open River	26-50	4	11
Open River	2-25	3	18
<i>Illinois River</i>			
La Grange Pool	81-157	5	39
Alton Pool	1-80	4	22

(Table 2). We then estimated the potential for flooding for each combination of river mile, elevation, and duration. Model results for the Upper Mississippi and lower Illinois Rivers are available to the public from the Upper Midwest Environmental Sciences Center's web site at http://www.umesc.usgs.gov/data_library/water_elevation/flood_potential.html. At the web site, tables are grouped for ease of access by pool or by 25-mile reach for the Open River (Table 2).



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