

The Missouri River Floodplain: History of Oak Forests & Current Restoration Efforts

*Dan Dey, Dirk Burhans (U.S. Forest Service, North Central Research Station);
John Kabrick, Brian Root, Jennifer Grabner, (Missouri Department of Conservation),
Mike Gold (University of Missouri); 202 ABNR Bldg., Columbia, MO 65211;
ddey@fs.fed.us*



Efforts to restore floodplains are complicated by our variable understanding of history and ecology; our lack of knowledge of past environmental and vegetative conditions; and our differing viewpoints of what is natural, what the role of humans is in the ecosystem, and what the desirable restored state is. Managers are challenged to decide how to restore native vegetation and hydrologic regimes in the Mississippi and Missouri River floodplains because they are among the most altered ecosystems in North America.

Long before Europeans set foot in North America, humans were modifying their environment with fire, agriculture, husbandry of wild game, and cultivation of native plants. Before 1000 A.D., Native Americans in the eastern North America were farming the floodplains, where they grew large fields of corn and other crops (e.g., up to 3,000 acres). Their main villages were situated along rivers and major tributaries. Agricultural production of beans, corn, and squash allowed Native Americans to establish more permanent villages with larger populations. For example, from about 700 to 1200 A.D., the city of Cahokia along the Mississippi River near present day St. Louis grew to dominate culture and commerce in the Southeast and Midwest (population estimates range from 20,000 to 40,000). The city covered 6 mi² and was surrounded by extensive crop fields. A two-mile timber palisade of 20,000 oak and hickory trees surrounded the city center. Collapse of the civilization in the 1400s is attributed to resource depletion, disease, crop failures, and social unrest.

Although humans have modified floodplain vegetation for millennia, the greatest transformation of the Lower Missouri and Upper Mississippi Rivers has occurred in the past 100 years. Initial efforts to improve navigation on these rivers involved the removal of snags and the dredging of sand bars and reefs during the 19th century. Not until the early- to mid-1900s did Congress authorize and fund programs to channelize these rivers by building wing dams, pile and rock dikes, impoundments, and levees to achieve a constant channel width and depth for navigation and flood control. Meanwhile, the ecology of these riverine habitats was greatly altered by the new hydrologic regimes and river dynamics. Separating the river from its floodplain by building levees and blocking side channels changed the nature of riverine flora and fauna by modifying the frequency and impact of floods. Forest clearing and conversion to agriculture have eliminated up to 95% of bottomland forests in the Missouri and Mississippi basins. Additionally, urban sprawl is a relatively new factor causing significant changes in floodplain ecosystems, and is being recognized as a major national threat to our natural heritage.

The Great Floods of 1993 and 1995 destroyed levees and ruined farmland by scouring fields or by depositing sands. The floods brought national attention to the declining quality and productivity of floodplains and the way in which human modifications of these environments has intensified or exacerbated flood events and flood damage. Post-flood studies have recognized the value of mature floodplain forests for protecting levees and providing temporary flood water storage. In Missouri, public agencies have been acquiring lands that were once prime farmland but have been rendered non-tillable by the Great Floods. These agencies desire to restore more natural floodplain vegetation and hydrologic regimes on these lands.



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Historically, oaks were significant components of native floodplain forests in the Missouri and Mississippi watersheds. Cottonwood, silver maple, willow, and other flood-tolerant species dominated low elevation, flood-prone areas. Oaks, hickories, and walnuts persisted on the better drained soils on slightly higher elevations in the bottoms. Portions of floodplains disturbed by frequent scouring and deposition were invaded by colonizing willows, cottonwoods, and other wetland shrub and herbaceous species. Annual and semi-annual floods created a mosaic of vegetation that was diverse in age, structure, and composition. Analyses of General Land Office surveys conducted in the early 1800s have shown that mature forests were once common along the lower Missouri River. Oak, black walnut, and hickory were common in these diverse forests. Today these species are largely absent in the forest remnants. Bottomland prairies, savannas, and woodlands were prevalent along certain stretches of the Lower Missouri and Upper Mississippi Rivers. These communities were probably artifacts of various combinations of anthropogenic fire, flood regime, and geomorphology. In the 19th century, prairies covered 26% to 46% of the bottoms for 200 miles upstream of Boonville, MO, and in the Mississippi River floodplain from St. Louis north into southeastern Iowa. Extensive prairies dominated the river bottoms north toward the Falls of St. Anthony and west to the Rocky Mountains. The lower Mississippi south of St. Louis was heavily forested with mature, closed-canopied forests.

Conservation managers are interested in restoring oaks and other nut producing tree species in floodplain forests and abandoned agricultural lands, which are regenerating to willow, cottonwood, and silver maple since the Great Floods. Regenerating oaks in productive floodplains has proven difficult because of their slow juvenile growth habit and their adaptations to specific soil and microtopographic environments within these areas. Many natural fluvial processes have been altered, thereby changing soil, microtopographic and hydrologic patterns which in turn complicates oak regeneration in floodplains. Traditional methods using bareroot seedlings or direct seeding with acorns, and vegetation control by herbicides have not been reliably successful.

We initiated a study to test different nursery stock types, oak species, site preparation methods, and non-chemical weed control techniques for regenerating oaks in agricultural fields along the Missouri River. The study is comprised of six 40-acre blocks that are equally divided between two areas owned and managed by the Missouri Department of Conservation: Smokey Waters and Plowboy Bend Conservation Areas. Crops were grown in these fields until 1998. Plowboy Bend is protected from the river by a levee; Smokey Waters is not. On two of the 40-acre blocks at each site, RPM and 1-0 bareroot seedlings of pin oak (*Quercus palustris*) and swamp white oak (*Q. bicolor*) were planted in mounded or non-mounded soil in the fall of 1999. Trees were planted with either a cover crop of redtop grass (*Agrostis alba*) or allowed to compete with natural vegetation that invades abandoned croplands.

RPM is a trademark for the Root Production Method, an air root pruning process developed by Forrest Keeling Nursery in Elsberry, MO. This nursery culture technique produces large planting stock that have dense, fibrous root systems in 3 or 5 gallon containers. These trees show substantial growth after only a short period of time; for example, a two-year old RPM swamp white oak is already 5 to 8 feet tall; typical bareroot nursery seedlings of comparable age are usually less than 3 feet tall. RPM seedlings often produce acorn crops after only 3 to 5 years of age, further hastening their ability to reforest new sites and provide wildlife food; typical bareroot nursery stock does not mature to produce acorns until age 20 to 30.

Overall, we planted more than 7,500 trees on a 30' x 30' spacing. The third 40-acre block at each site was left untreated and will serve as a control for the experiment. We are monitoring planted tree survival and growth; soil moisture, temperature and fertility; vegetation succession and weedy competition; and songbird abundance and breeding success in relation to the different regeneration methods, including the control block.

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The aims of this study are not simply to reforest these two bottomland sites, but to learn how to restore a hardwood component to bottomlands, and to discover the effects of this reforestation on wildlife communities. The results of this research will lead to recommended methods of oak regeneration to (1) diversify native forests that develop on abandoned cropfields by supplemental planting of oak and other nut producing trees, (2) incorporate oaks and nut trees in agroforestry operations, and (3) sustain oaks in greentree reservoirs and other waterfowl habitat areas. As one example, this research may suggest ways for managers of waterfowl hunting reserves to include nut-producing trees in their restoration and management plans, providing valuable food for sustenance of winter duck populations. Humans always have and will continue to influence floodplain environments, but our hope is that by learning about processes of hard-mast reforestation, these habitats can be managed in more productive and valuable ways.

Funding for this research is made possible by support from the University of Missouri Center for Agroforestry.

Announcements and Notes

- ♣ We are currently seeking articles for the April 2001 issue of *The Glade*. If you would like to write an article for the April or future issues, please contact Michelle Boone at mdb7ef@mizzou.edu.
- ♣ The annual meeting for the Missouri Society of Conservation Biology will be held at the Missouri Natural Resources Conference (MNRC) at Lake of the Ozark's *Tan-Tar-A* on January 31-February 2, 2001. Please check the MNRC web page for the conference schedule: www.mnrc.org.
- ♣ During the past year we invited contributions of voluntary dues from our membership. We sincerely thank those who responded with their financial support of MOSCB: Bill Dijak, Jane Fitzgerald, Pat Graham, Nels Holmberg, Brad Jacobs, Kim McCue, and Alan Templeton. If you wish to give a contribution to our society (\$15 members, \$5 students) to cover society expenses and newsletter distributions, please make checks payable to MOSCB and mail them to Chrissy Howell at Department of Biology, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121.
- ♣ Our parent organization, the Society for Conservation Biology has a web site at <http://conbio.rice.edu/scb>. Individuals interested in membership with the society can view their web site for more information or contact Alice Blandin at conbio@u.washington.edu.
- ♣ Tropical Dendrology in Costa Rica: Every year, the Tropical Science Center in San Jose organizes two-week field-based workshops in Costa Rica to teach the techniques of tree identification in Tropical America with a focus on the major life zones of Costa Rica. In 2001, two versions of the course will be offered, one in Spanish (March 12th – 24th) and one in English (June 25th – July 7th). Anyone interested in participating should contact Dr. Humberto Jiménez Saa at hjimenez@racsa.co.cr.
- ♣ New MOSCB officers for 2000-2001 are Kim McCue (president); David Giblin (vice-president); Chrissy Howell (treasurer); John Archer (secretary); and Bill Dijak (past-president).