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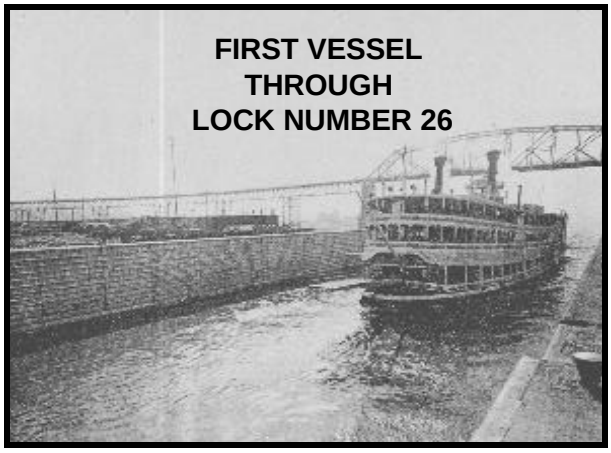
The Upper Mississippi River

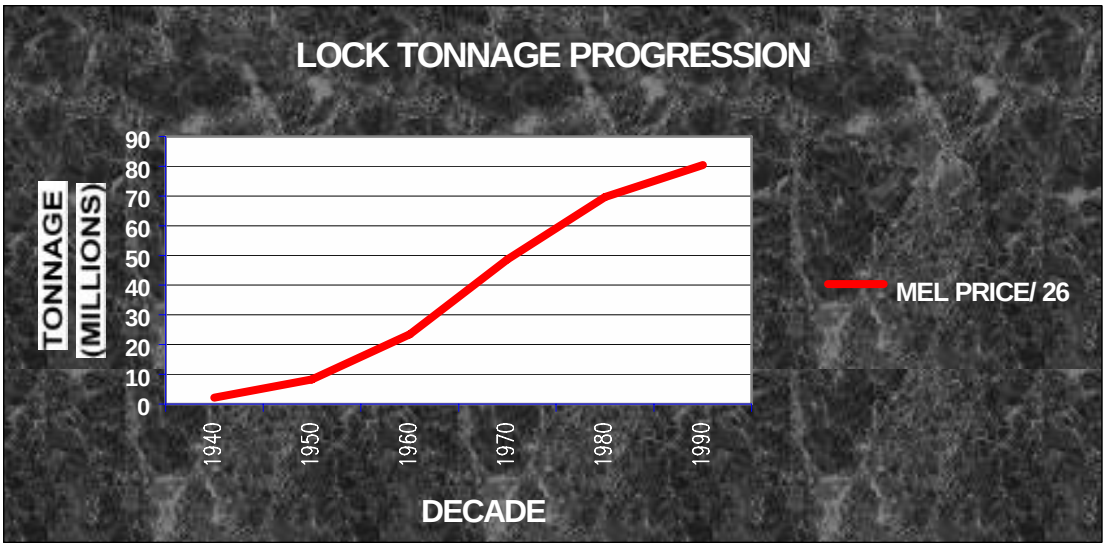
History



Congressional Action: In 1930, Congress authorized the current 9-foot navigation channel. A series of locks and dams would be constructed to maintain a minimum navigation channel depth of nine feet during low river stages. The nine foot channel would be supplemented by dredging as needed.

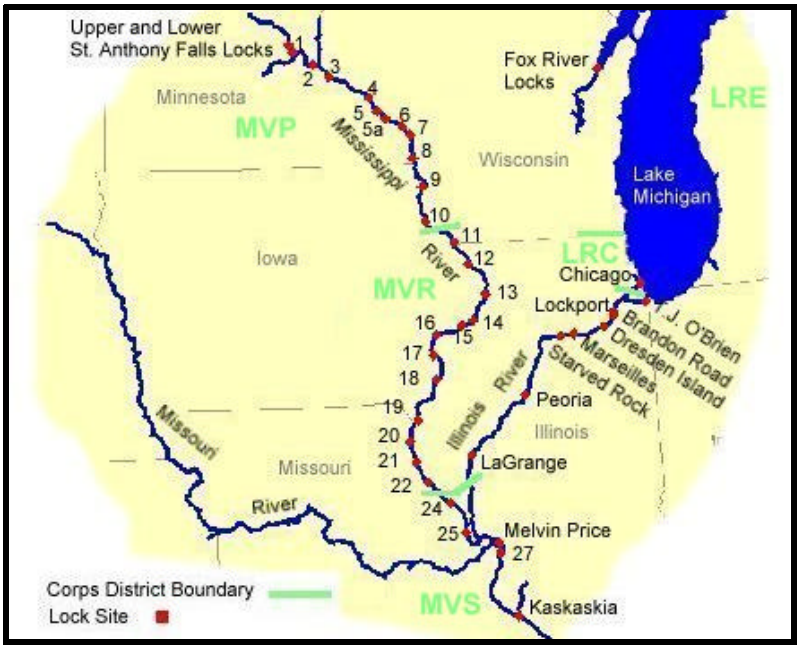
Navigation Success: The Locks and Dams have been an overwhelming navigation success. For example Melvin Price Locks and Dam, near Alton, Illinois, passes 70 to 90 million tons of cargo each year.

Environmental Concerns: One principal concern expressed by river and wildlife biologists relative to the management of the navigation pools is the overall health of the ecosystem. They believe the natural water level fluctuation allows for tremendous biological diversity and sustainability of the Upper Mississippi River (UMR) ecosystem. They believe that the navigation pools prevent the normal annual low water, that allowed wetland (emergent aquatic) vegetation to grow naturally.

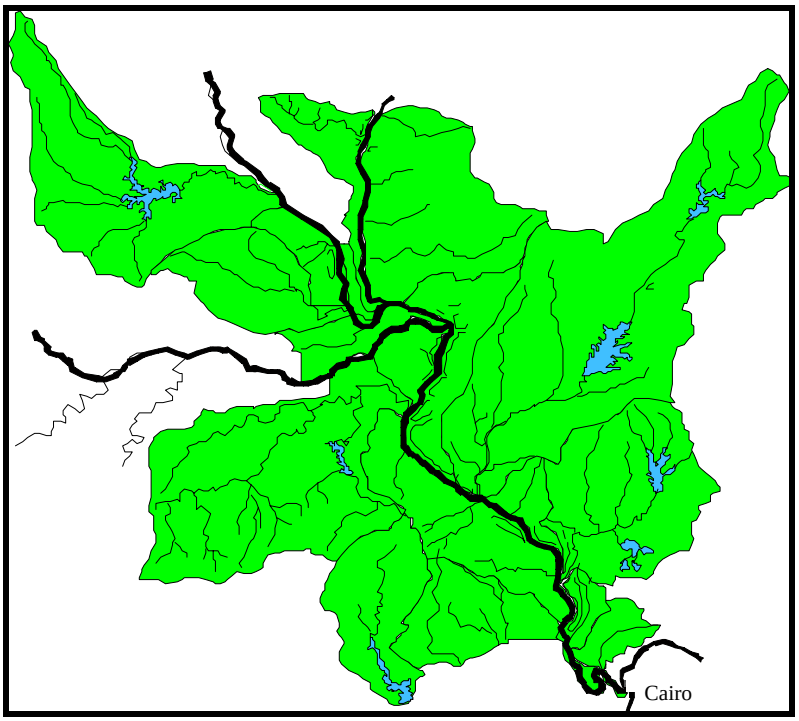


The Upper Mississippi River

Geography



The Upper Mississippi River courses 1,036 miles from its headwaters in northern Minnesota to its confluence with the Ohio River at Cairo, Illinois. In doing so, it passes through the five states of Minnesota, Wisconsin, Iowa, Illinois, and Missouri. This portion of the Mississippi watershed drains 121 million acres (189,000 square miles).



The St. Louis District is responsible for the lower 300 mile portion of the Upper Mississippi River.

Concerns

Under Natural conditions, water levels are normally lower in summer months. Low water promotes growth of aquatic vegetation, which is essential to sustain biological diversity. As the pools formed above the UMR locks and dams, water levels were kept artificially high to assure adequate depth of the navigational channel. As a result, aquatic grasses, which provide habitat for waterfowl and fish populations, diminished.

Hundreds of miles downstream, scientists working in the Gulf of Mexico reported high mortality of aquatic organisms (such as shrimp and mussels), an occurrence traceable to nitrogen runoff from fertilizer use in the Corn Belt.

As well as being a nationally significant waterway, the UMR is a nationally significant ecosystem. River and wildlife biologists believe that sustainability of the river's vast biological diversity depends on natural water fluctuations. A primary concern was the absence of annual low water that allows aquatic vegetation to grow. Although this concern was shared by the Corps, which continually evaluates opportunities to improve the environment as well as navigation, for 60 years the question remained: *How could the ecological problem be remedied without compromising navigation?*

Value of Macrophytes

Macrophytes (vegetation) provide a variety of benefits to a river ecosystem. These benefits include wildlife and fish habitat, cover and food sources, erosion control and water supply improvement.

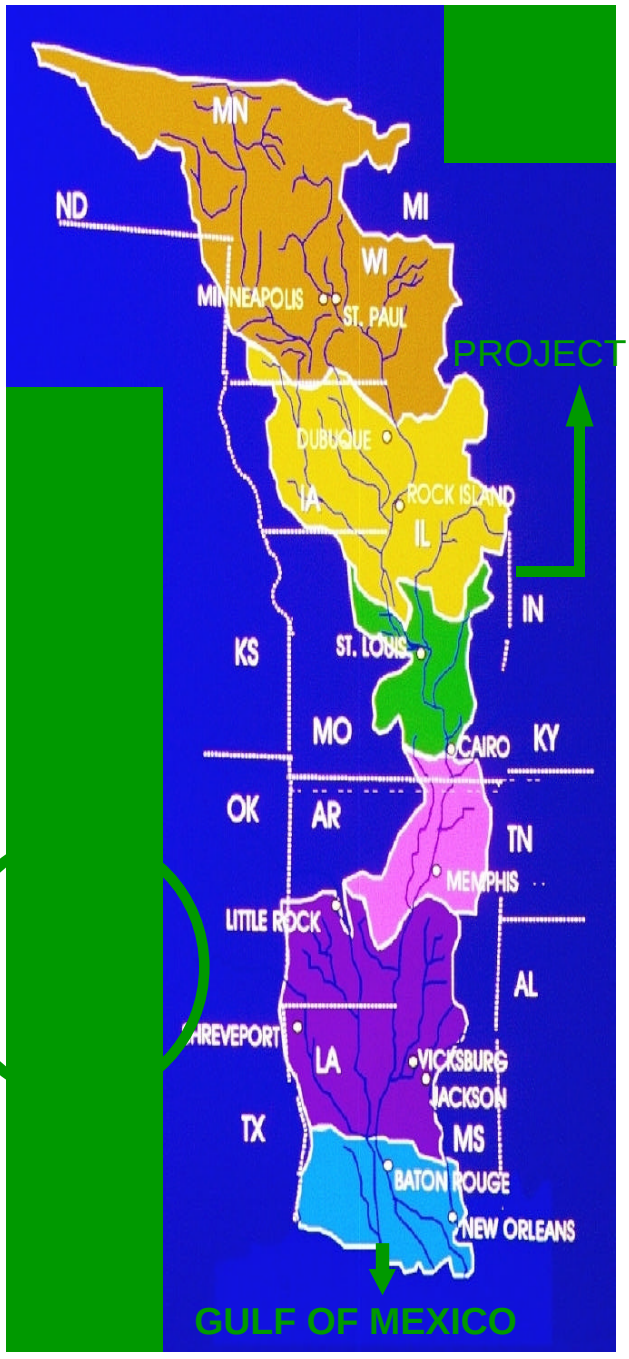
The North American Waterfowl Management Plan has identified the UMR as 1 of 34 waterfowl habitat areas of major concern in the United States and Canada. Concerns on the UMR include the river's long-term viability as an excellent migratory resource in the face of a shrinking macrophyte community.

Millions of birds follow the UMR during their annual migrations. During the fall migration, these birds require high energy foods. Macrophytes provide this energy through the seeds they produce. During the spring migration, the birds (especially the females who are preparing to produce eggs), still require high protein food. They find these proteins in aquatic insects supported by dead and dying vegetation.

It is commonly accepted that macrophytes are beneficial to waterfowl. Unfortunately, in some cases management practices that are beneficial to waterfowl are actually detrimental to fish. The EPM program provides benefits to both waterfowl and fish (mallards and blue gill for example).

In 1988, the Upper Mississippi River Committee published *Fishes Interactions With Aquatic Microphytes With Special Reference to the Upper Mississippi River System.* In that report, they found that:

Value of Macrophytes



more than half of the fish species on the Upper Mississippi River system use macrophytes. Aquatic plants, and the insects which use them, serve as food for the many variations of fish. Aquatic plants also provide places for fish to lay eggs and for larval fish to hide from predators.

Studies have shown that waters from the Mississippi River contain high levels of nitrogen. Urban and agricultural sources contribute to the high nitrogen levels. These nutrients serve as a fertilizer for algae in the Gulf of Mexico, causing huge algal blooms. As algae dies, it falls to the bottom of the Gulf and decomposes. This decomposition requires large amounts of oxygen, which are drawn out of the water creating a large area of low or no oxygen. This alluvial zone of low oxygen, called the hypoxic zone, cannot support most aquatic habitat like shrimp, mussels, and fish which draw oxygen from its waters. The pooled portion of the Mississippi river, above the mouth of the Missouri River, is thought to contribute about 31 percent of the nitrogen delivered to the Gulf.

EPM's restoration of the wetland vegetation benefits the entire ecosystem from the UMR to the Gulf of Mexico.

Value of Macrophytes

STAG ISLAND - 07/18/96

STAG ISLAND - 7/26/96, 10" OF CLEAN WATER

STAG ISLAND - 08/03/96

STAG ISLAND - 08/11/96

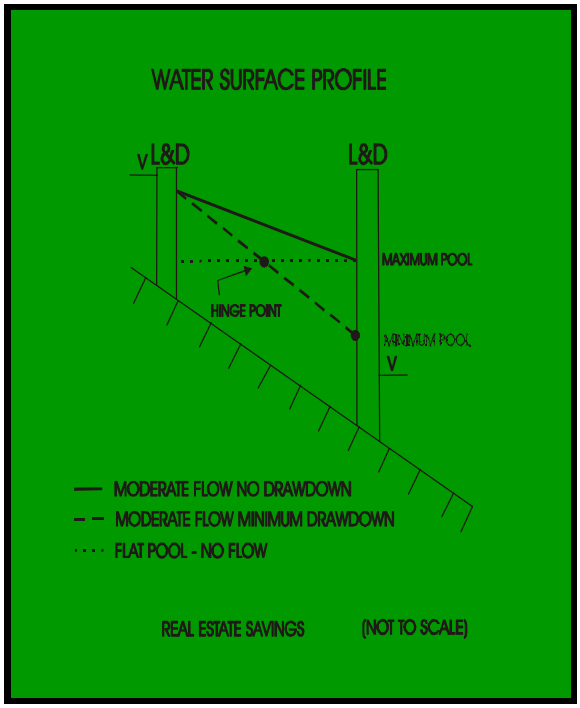
Wetlands play significant roles in water quality improvement for certain chemicals, sediments and nutrients. One study showed that when wastewater was passed through a wetland, 70 percent of ammonium nitrogen, 99 percent of nitrite and nitrate nitrogen and 95 percent of total dissolved phosphorous were removed. Much of this water quality improvement can be directly attributed to macrophytes taking up the nutrients during growth periods.

Empirically it may be stated:

a. As soils are allowed to dry sufficiently, nitrogen is released safely into the atmosphere.
b. Wetland vegetation will use nitrogen as it grows.
c. The positive ammonium can be neutralized by negatively charged soil particles.

The wetlands created from this project should not be considered a complete solution to the problem of the hypoxic zone in the Gulf of Mexico. However, expansion of the EPM program to the entire UMR Lock and Dam system has the potential to measurably reduce the amount of nitrogen entering the Gulf of Mexico.

Traditional Operation



The dams create slack-water pools for navigation during periods of low and medium flows. The locks pass river traffic from one pool to another. In order to operate the slack-water pool system, it was necessary for the federal government to acquire interest in all real estate (lease and purchase) that would be subject to flooding caused by the use of the dams. In order to lessen these real estate requirements, the St. Louis District's three Mississippi River Locks and Dams (L&D's) are regulated using a hinge-point.

Hypothetically, if there were zero discharge in the Mississippi River, the water surface between two L&D's would be level. Maximum pool must be maintained at the downstream L&D to maintain the authorized 9-foot channel at the upstream most point in the pool. As river flows increase, the upstream portion of the pool rises, lessening the need to maintain maximum pool. Utilizing a hinge-point, the water level at the downstream L&D is lowered to reduce real estate requirements and still maintain a 9-ft channel throughout the pool.

The hinge-point method of managing water levels allows for a range of water levels for various flow rates. The modern technology now available to a water control manager (i.e., data collection platforms, satellite transmissions, and computers) was not always available. Without the advantage of modern technology, water control managers of the past had to work in the middle of the hinge-point range.

Flow rates on the Mississippi River are very dynamic and can be altered dramatically due to variables such as precipitation, ice, and hydropower generation. The water control manager of the past had only one value per day to use in making water control decisions. The water control manager attempted to keep the pool in the middle of the hinge-point range to provide for the unknowns.

Drawdowns utilizing the traditional method, were generally not sufficient to provide a valuable vegetative response (the tops of vegetation needed to be above the water surface). The drawdown was too small and more importantly, too short in duration to produce viable habitat. The typical drawdown in Pool #25, for example was between 0.5-1.5 feet for about 20 days. The duration of the typical drawdown was insufficient to produce vegetation that was able to remain above the water level when the pool was returned to the maximum regulated pool.

The Traditional method allowed for a safe and dependable navigation channel. However, it was unable to produce the kind of vegetative response the river biologists were looking to achieve. Historically, in only one of every four years a drawdown of 0.5-1.5 feet was achieved for 30 days.

Solution

The Corps of Engineers' principal focus in ecosystem restoration is on those ecological resources and processes that are directly associated with the hydrologic regime of the ecosystem. Human influence has had, and will continue to have, an impact on virtually all ecosystems. This should always be recognized when developing ecosystem restoration goals and objectives.

During the 1994 annual Spring coordination meeting among the Corps of Engineers, Missouri Department of Conservation (MODOC), Illinois Department of Conservation and the U.S. Fish and Wildlife Service, water level management was a major focus. The water control managers asked the river and wildlife biologists to clarify their environmental pool management goals with a suggested pool water level management schedule. In response to this request, a set of parameters and a period of time desired was provided by the Missouri Department of Conservation. Since the parameters and the time period were both possible and within the water control management authority, the water management schedule was immediately implemented. An evaluation of this "experiment" by the Missouri Department of Conservation was to be conducted during the test period and the results provided to the Corps of Engineers water control managers.

Solution

The parameters that were used in this experiment included:

1. Provision of a safe and dependable navigation channel.
2. Utilization of the following vegetative growth parameters:
   a. Employ a pool drawdown of at least 0.5 feet for at least 30 days.
   b. Employ a pool drawdown from May 1 to July 30, as this period is the most suitable for vegetative growth and seed production.
   c. After the initial drawdown, allow the pool to rise at a rate of not greater than 0.1 foot per day. Vegetation will grow at a rapid rate if not overtopped by water and if a slow pool rise is provided.

An important feature of the plan is close coordination with resource managers in the field, who provide valuable insight into actual conditions. As with any natural process, the vegetative response will vary from year to year. Time of year, temperature, and precipitation all have an effect. The resource managers in the field provide meaningful real time input on the vegetative response and provide significant suggestions relative to needed adjustments. For example, in 1996 several plant species germinated during the middle of the drawdown and additional time was requested to allow these species to gain sufficient height.

The MODOC provided the initial monitoring of the project. They established various control locations in all three pools within the St. Louis District. The vegetative response was greater than originally envisioned. Preliminary estimates revealed that over 2000 acres of vegetation were created as a result of this first experiment.

After the successful 1994 experiment, the decision was made to continue the experiment. The monitoring done by MODOC was much more extensive in each of the following years (1995 - 1998).

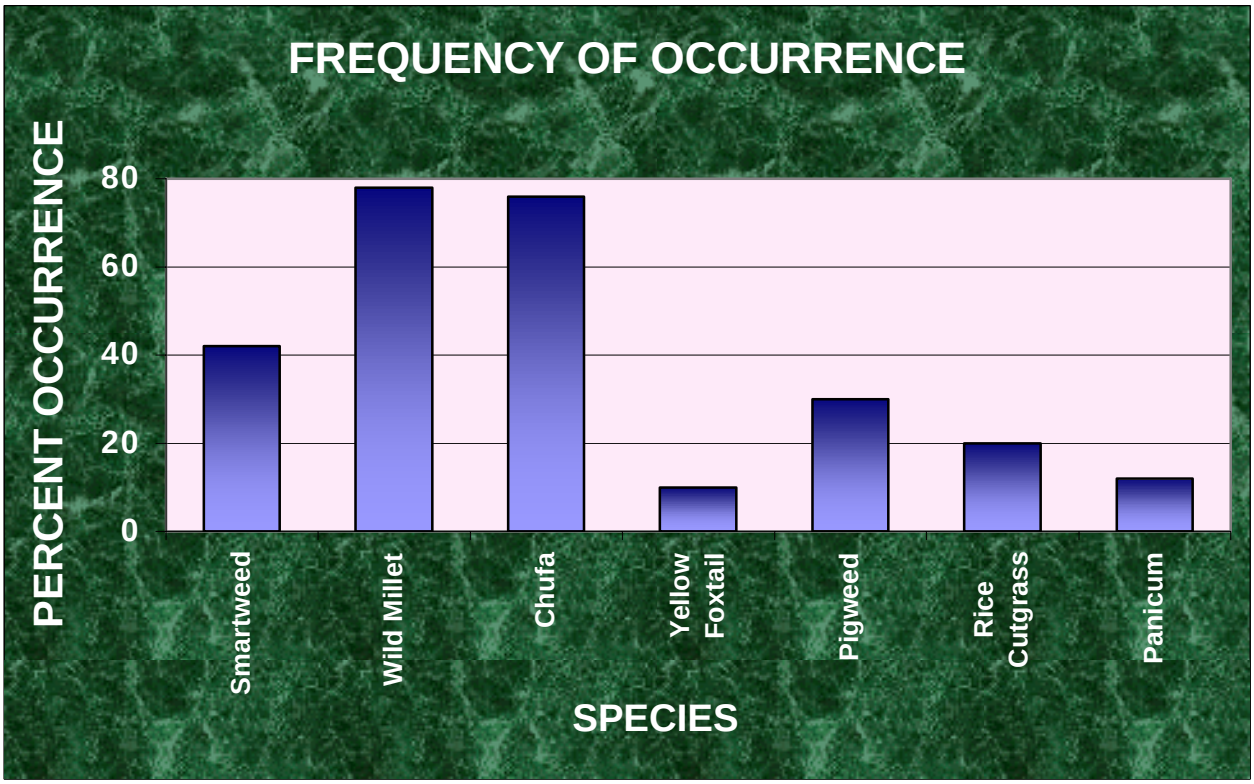
Evaluation

A total of eight sampling sites were established for evaluation. In Pool 24, sites were established at Crider Island, Pharrs Island, and at Clarksville National Wildlife Refuge. In Pool 25, sites were established at Stag Island, Jim Crow Island, Turner Island, and Batchtown. The only site established in Pool 26 was at Dresser Island.

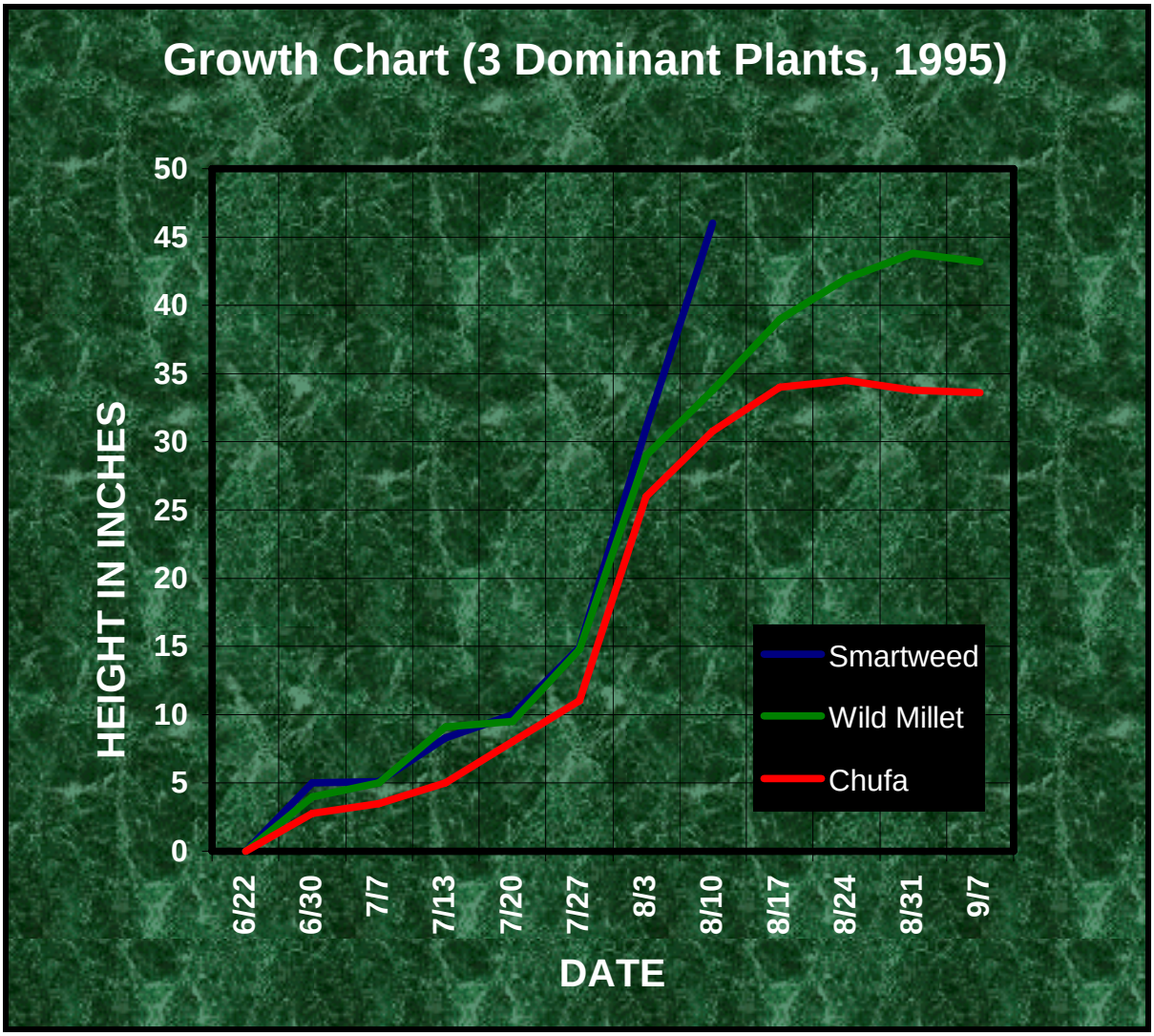
Points were set at several different elevations. A 1.5-foot template was used to record various vegetation parameters. The species, number, and height of the vegetation within the 1.5-foot square were recorded. In addition, photographs were taken at each site during the weekly visits.

Seven genera of vegetation were identified in the 20 different sample sites during 1995. The results for 1994 and 1996-1998 were very similar.

Frequency of Occurrence for Each of The Seven Genera During 1995.



A rigorous documentation system was implemented, with eight sampling sites established (three at Pool 24, four at Pool 25, and one at Pool 26). Photos were taken weekly from three photographic points at each site, 0.5 feet apart in elevation, to document vegetative types and rates of growth.



Approximately 30 days were required for plants to grow to a height of 7-10 inches during the Summer of 1995. From this point, the UMR pools were slowly raised back to maximum regulated levels and the vegetation responding with dramatic height increases in mid to late July. The graph above illustrates the average growth of the three dominant genera of plants, inclusive of all monitored sites.

The three dominant genera had similar growth patterns during the first five weeks. After five weeks, the growth pattern began to diverge. Chufa leveled off at 35 inches, millet leveled off at 40 - 45 inches and smartweed was continuing to grow at the time of the last survey (shown above).

Environmental Pool Management is one of the most exciting and significant river management techniques to occur on the Upper Mississippi River in a long time.

- J. Harrison, Minnesota Wisconsin Boundary Area Commission

Riverine ecosystem benefits continue to exceed original projections and expectations. This program has set an excellent example of how water regulation should be expanded to the entire pooled portion of the Upper Mississippi River.
- Jon Duyevejonck, Upper Mississippi River

Their (the Corps) Mississippi River water level management project is a superb example of riverine ecosystem benefits that can be realized when agencies work together.

- Jerry J. Prestley, Director, Missouri Department of Conversation

RIVER GAMBLIN'

An Army Corps of Engineers crew broke 70 years of tradition in managing the mighty Mississippi, drawing down the water level to provide grassy stopovers for migrating birds.

By MARLA CONE
TIMES ENVIRONMENTAL WRITER

ALTON, Ill.—Watching grass grow wasn't always a priority at Locks and Dam No. 26.

The technicians here, staffing the controls of one of the world's mightiest rivers, are entrusted with keeping billions of dollars in cargo vital to the nation's economy navigating safely through St. Louis. But quietly, hoping not to draw attention to himself, David Busse broke 70 years of tradition to change the way the Mississippi is managed.

Quite literally, Busse and his crew at the Army Corps of Engineers are matching the pace at which grass grows, opening and closing the Mississippi's gates to manipulate its pools down to a fraction of an inch so that birds and other creatures can thrive there.

Navigation tradition dies hard in the corps, which has long struggled to control nature, not empower it. As champions of commerce and defenders of public safety, corps engineers build dams. They channelize streams. They stop floods, or at least try to. And in doing so, they have destroyed many of the wetlands and grasses that nourished North America's migratory birds.

But that mind-set is slowly changing, and it happened unceremoniously here, where the engineers simply took matters into their own hands one day about three years ago. With little more than the flip of a switch, Busse's team has created 3,000 acres of new grasslands along the Upper Mississippi, a stopover for hungry and tired migratory birds.

Every summer, the technicians draw down three deep pools that jut out along the river, keeping them low for 30 days. As the water retreats, seeds germinate and grass creeps toward the sun's rays. Then, the technicians raise the water at the painstakingly slow pace of an inch or so a day to keep the surface just below the tips of the new grasses.

The drawdown leaves the river with less of a cushion for ships, which means the corps gatekeepers must be extra vigilant. Almost 80,000 ships and barges pass through these locks yearly, carrying 78 million tons of corn, coal, crude oil and other goods.

"It requires a lot more checking of the hydraulic situation upstream because if we are wrong, we can lose navigation," Busse said. "We only have one project purpose—to maintain navigation—and we will not and cannot do anything to imperil that. So when we are operating on this fringe, we are taking on a lot of responsibility. But we think the benefit is well worth it. We are giving nature enough time to grow the grasses."

In an era when many environmental issues are polarized, when the usual refrain from the behemoth, slow-moving corps is "no way" or "let's study that," the change in river management shows conservation can be relatively simple and painless.

During the drawdown, a Missouri biologist heads out every week to measure how much the grasses, called smartweed have grown. Then Busse or one of his staff continuously monitors the flow from upstream and calculates how much to manipulate the gates controlling the river to match the grasses' growth. A technician punches the data into a computer, opening the gates to lower the pools, closing them to raise the water level. Sometimes the instructions need to change every half-hour to keep up with the river's changing flow.

The lush, emerald green quilt provides an oasis for ducks, herons, terns, rails and other birds that need to rest and feed during their long journey along the flyway's course. Nationally, more than half of all wetlands and grasslands have vanished, and because of the loss of habitat, waterfowl populations plummeted in the 1970s and 1980s. They are now beginning to rebound because of conservation efforts and improved weather conditions in the United States and Canada.

The new grasses also help filter pollutants that flow down the Mississippi to the Gulf of Mexico.

"Three thousand acres is a substantial area of new habitat," said John Smith, a wildlife research supervisor at the Missouri Department of Conservation. "We've lost a lot and what we've tried to do is offset some of those losses."

Scott Faber of the environmental group American Rivers, a longtime critic of the corps' management of the Mississippi, complimented the St. Louis team for "some innovative things to create habitat that are consistent with the navigation purposes of the river." And Sean Kelly, a migratory bird specialist at the U.S. Fish and Wildlife Service, said the corps "seems a little more open to experimenting."

Environmentalists had long wanted the corps to draw the pools down, putting a virtual halt to navigation for the entire summer. The corps dismissed the requests as extreme.

But on a summer day in 1994, Ken Dalrymple, a Missouri state wildlife biologist, visited the lock to discuss less drastic ideas for handling the pools. Busse couldn't tell a mallard from a tern, and he couldn't fathom why anyone cared so much about grass. But he listened as Dalrymple told him about the river's shrinking "macrophyte community" and how the Upper Mississippi ranks among 34 waterfowl areas of critical concern in the country.

Busse knew drawing the pools down would remove some of the comfort zone for ships. But he also knew that satellite readings are so sophisticated that they provide an early warning about any unforeseen risk of a river that is too shallow.

Altering the drawdown is within his power, so Busse didn't ask his superiors for permission. "I got up from that table and made a call to my technician and said, 'Don't raise the pool.' It began that day, and we've been doing it since," Busse said.

Since then, superiors at the corps have studied and sanctioned the drawdown and confirmed that it poses no threat to shipping. Claude Strauser, chief of Busse's section, said that although the carefully paced emptying and filling means the managers must be more attentive, there is no added cost because they staff the locks 24 hours a day anyway.

Along other river reaches, the corps is contemplating similar moves. Upstream in St. Paul, Minn., 10,000 acres of grasslands could be created in one pool alone.

Some of Busse's colleagues ridicule the policy at Locks and Dam No. 26 as frivolous, or simply "not the way we do things here." But Busse says: "If they want to know if it'll work, they can come out here and see."

Ensuring that ships pass safely to and from the Gulf of Mexico has always been—and always will be—the corps' primary mission. But now Busse takes great pride in watching birds feeding along the grassy banks. The corps even won a conservationist of the year award in 1996. Who, Busse asks, would have ever envisioned that?

Barges and Birds

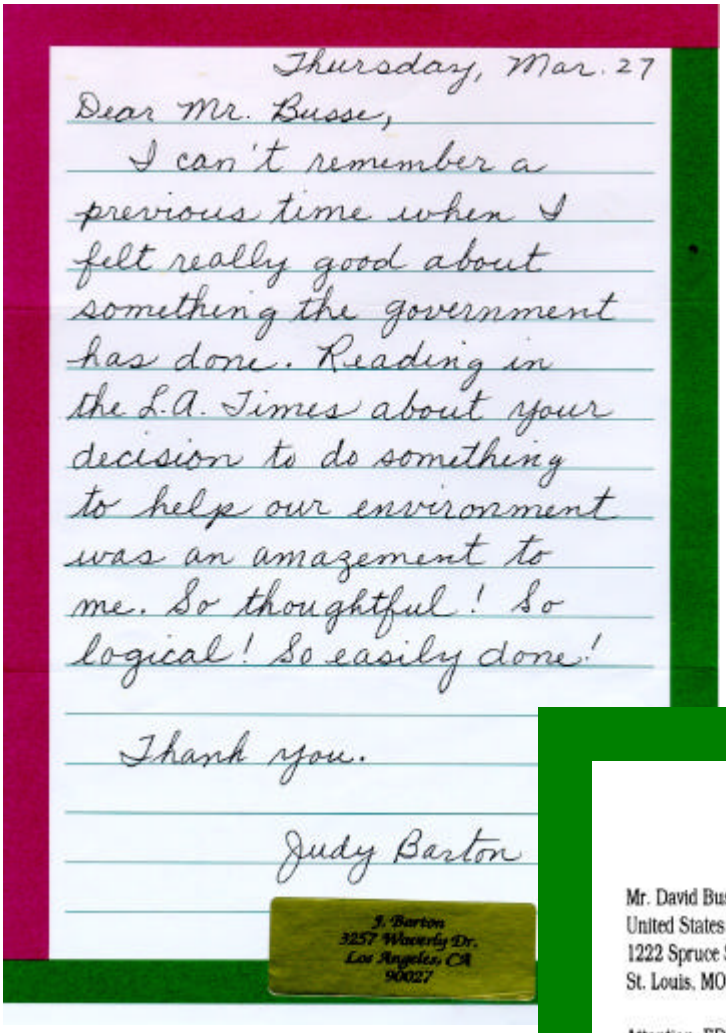
Locks and dams are critical to navigation on the Mississippi River. By manipulating them, the Corps of Engineers keeps the channel deep enough for ships to pass through safely. But in St. Louis the corps has altered how it controls the river, in order to assist wildlife. In summer, three pools alongside the river are drawn down for about 30 days so grasses can grow, see below, providing an oasis for migrating birds.

ROB HERNANDEZ / Los Angeles Times

Los Angeles Times

Testimonials

ENVIRONMENTAL POOL MANAGEMENT



Thursday, Mar. 27

Dear Mr. Busse,

I can't remember a previous time when I felt really good about something the government has done. Reading in the L.A. Times about your decision to do something to help our environment was an amazement to me. So thoughtful! So logical! So easily done!

Thank you.

Judy Barton

J. Barton
3257 Waverly Dr.
Los Angeles, CA
90027

31 March 1997

Mr. David Busse
United States Army Corps Of Engineers
1222 Spruce Street
St. Louis, MO 63103

Attention: ED-HPW: David Busse

Dear Mr. Busse:

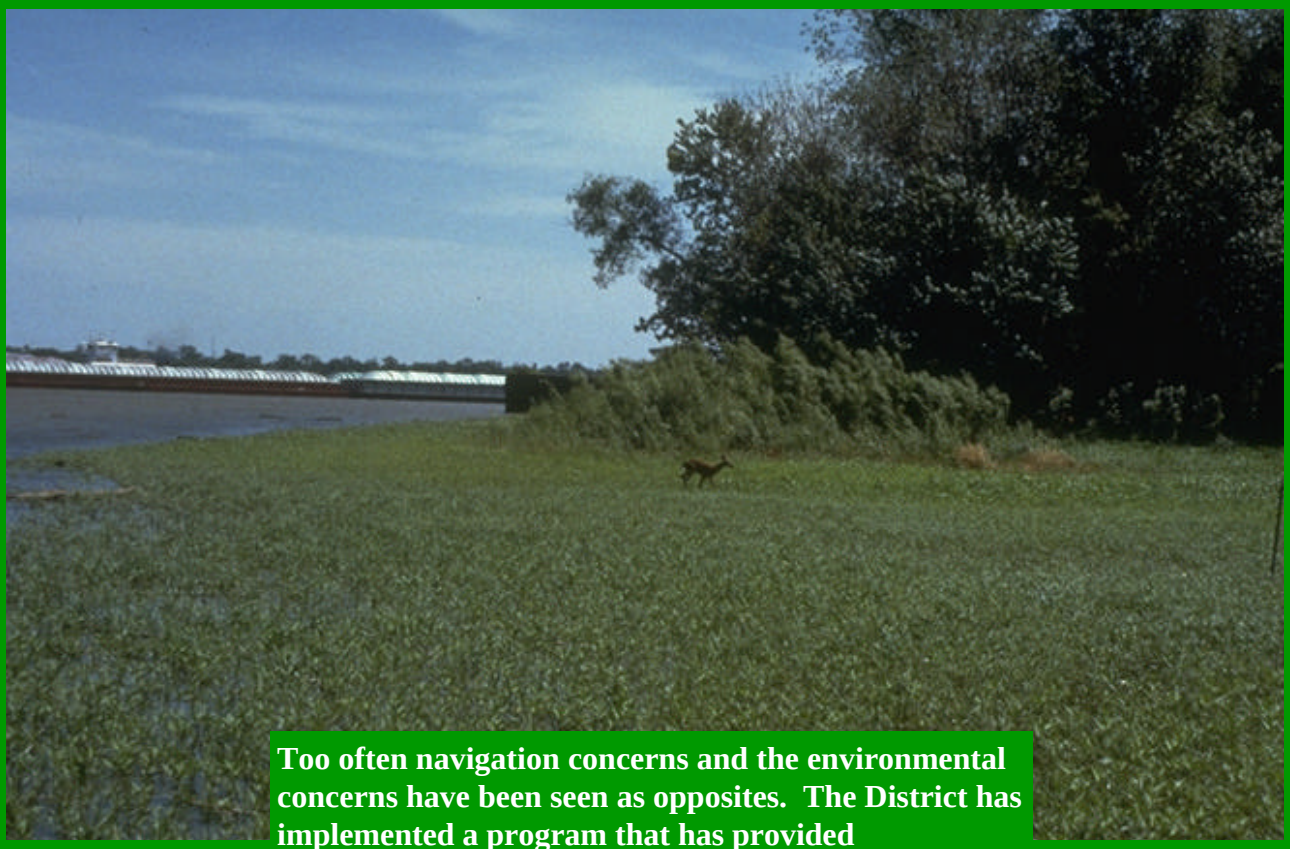
Our local, major newspaper, the *Los Angeles Times*, on 27 March featured an article by Marla Cone in the Science File, part of the Metro section, itself presenting local news, weather & editorial pages.

The piece: *River Gamblin'* concerned your work on behalf of The Corps & The River, and I read it with great interest.

Thank you for your insight & courage, regarding the management of the waterway, over against the avian flyway, appurtanant to it. Your initiative is a model of enlightenment. I hope it is widely adopted by The Corps, and taken up by other governmental & private operators, who must balance water interests wisely.

Pennant regard,

Robert Rowan.



Too often navigation concerns and the environmental concerns have been seen as opposites. The District has implemented a program that has provided environmental benefits to the Mississippi River and a safe and dependable navigation channel for the navigation industry.
- Christopher J. Brescia, President, MARC 2000

The Environmental Pool Management Plan has won many awards including the Vice President Al Gore's National Performance Review Board's Hammer Award, the USACE Chief of Engineers Design and Environmental Awards Program's Honor Award, the American Rivers' first Mississippi River Award and the Conservationist of the Year Award presented by the Migratory Waterfowl Hunters, Inc.

Conclusion

"Our commitment to environmental stewardship will be measured by what we do, not by what we say."
Colonel James D. Craig 1993

Those who are concerned about local stewardship of the river's ecosystem are encouraged by this program. They see evidence of real progress and not just another study.

This project has required no additional taxpayer dollars. What was required was a willingness to be innovative and to work in a cooperative manner with a multitude of resource agencies and groups.

The EPM program, conducted by the St. Louis District, is an example of how the environmental and navigation communities can share the river in a mutually beneficial way. Coordinated water level management represents a true step toward ecosystem management on the Upper Mississippi River System.

EPM has been a success in 1994, 1995, 1996, 1997 and in 1998. Vertebrates and invertebrates were direct beneficiaries of vegetative growth. They used the wetland vegetative growth for both food and cover. Wetland vegetative cover is one of the most critical needs in the UMR food chain web.

The success of this restoration effort has resulted in a continuation of the EPM program in the St. Louis District. In addition, a fresh look at the EPM program in other Corps districts in occurring due in large part to the success of this program. The coordination and cooperation among the wildlife biologists and the water control managers will continue. Any serious restoration project cannot rest on its past successes. We must continue to strive toward a better understanding of the ecosystem and continue evolving our management practices to maximize the benefits.

"A permanent improvement must of necessity be designed and executed in entire harmony with the natural laws of the river
Colonel J. H. Simpson 1875