Our Mississippi

PARTNERING TO KEEP
AMERICA'S RIVER GREAT

SPRING '13

A river's-worth of teachable moments

WHEN MARILYN BEASLEY SAW the chance to explore a Mississippi River-based curriculum on a floating classroom, she scrambled to sign herself up. Then she signed up her students—all 55 of them. And then, she says with a laugh, she asked permission.

The science teacher at Briarcrest Christian School in Memphis, Tenn., has always looked for innovative ways to get messages across. One of her claims to fame is having been the real-life biology teacher of Michael Oher, subject of the book and movie, *The Blind Side*. She discovered that the once homeless boy, who would go on to be an NFL legend, could succeed when tests were administered verbally.

The "Our Mississippi" curriculum, developed by the U.S. Army Corps of Engineers and spearheaded by the staff of the St. Louis District's Rivers Project Office, similarly steps outside the norm to get learning across. But in this case, the mighty river is the innovative teacher.

The Mississippi is the common thread through lessons in science and ecology, archaeology, economics, literature, history and even how to find a river career. For students whose lives intersect with the river on a regular basis, a curriculum that hits so close to home is unexpectedly powerful, she and other teachers say.

ABOVE: ***Students explore nature at the Audubon Center at Riverlands in West Alton, Mo.***

PHOTO: U.S. ARMY CORPS OF ENGINEERS.

"It made them more aware that what they do on a daily basis affects the river," Beasley said. "They see how we're depending on it for transportation of our goods. We even had a discussion about cheaper gas prices by the river, compared to other locations farther away. They spotted a plastic bottle on the ground and now think about how that could get washed into a storm drain and into the river."

The "Our Mississippi" education program is a sister project to this "Our Mississippi" quarterly magazine, another outreach project seeking to forge river connections and thus inspire river protection and understanding. Activities throughout the program's 350-page guide are designed to meet state and national education standards. Lessons target 5th and 6th graders, but activity suggestions help make it relevant to lower elementary, high school, even college students.

"Some exercises feature pure river science, but the goal throughout is to create personal connections between students and the river's present, past and future," says Kimberly Rea, who manages the project through the Corps' Rivers Project Office in West Alton, Mo. A study of the journals of Lewis and Clark and their expedition supply list, for example, asks students to list what they'd take on a week-long camping trip and how the items might be similar or different. A "river as migration" unit not only looks at similarities and differences between migration patterns of animals and humans, but how students themselves were "migrants" if their family had ever moved from one home to another.

"The name 'Our Mississippi' was intentional," Rea said, for this project unlike anything the Corps of Engineers traditionally undertakes. "We said, 'Okay. It's ours. It's everybody's. Everybody needs to realize it's yours and you need to protect it, need to take care of it.

"We are the lead water resource provider and the largest

Continued on page 2 >>

Our Mississippi is a quarterly newsletter of the U.S. Army Corps of Engineers about its work in the Mississippi River Basin. It is published in cooperation with other state and federal agencies and other river interests with whom the Corps collaborates and partners toward long-term sustainability of the economic uses and ecological integrity of the river system.

New findings about Asian Carp, PAGE 6

FROM LEFT: ***Jo-Ellen Darcy, Assistant Secretary of the Army for Civil Works and a former teacher, displays a copy of the educator's guide and calls it a "resource not to miss." Technology is integrated into exploration of Ellis Island in the Mississippi River. Educators pose during an educator workshop facilitated by Living Lands and Waters.***

recreation provider in the nation. We have to educate people on how to take care of their public lands. If they don't know anything about them or how they tie back to their history and their lives in general, we'll never grow a new generation of stewards."

New connections are already being forged as teachers are using the guide in classrooms and trainers are preparing hundreds more. The way the project is taking on a life of its own is most exciting and gratifying, Rea said. "It's just what we wanted—to get something in people's hands they could get excited and passionate about so they could go out and start making positive changes and become advocates for the river and its health."

That the curriculum focuses on the Upper Mississippi and includes topics like culture and history stems from its origins in the Navigation and Ecosystem Sustainability Program. That multi-million-dollar project, approved by Congress, would expand the lock and dam system and restore much of the river ecosystem. As one way to mitigate potential damage from waves and other effects of added navigation traffic, Corps teams chronicled potentially sensitive archaeological river sites that might be impacted. Those were loosely integrated into other lessons on river history as a non-traditional means of protecting them.

"Most of the time," he says, "archaeologists will mitigate by excavating or protecting a site," he said. "Very few times do we have the opportunity to use public outreach as a venue for mitigation."

When Rea of the Rivers Project Office got involved, she and her staff went up and down the river, incorporating the expertise of others to make it the best guide it could be, blending in topics like biology and history and working to keep content timely, relevant and unbiased.

"That was always a major goal for everybody," Deiss said, "to present facts to children and young adults so they can investigate on their own and make well-informed decisions."

To create the content, the Corps hired the award-winning Portland-based Formations Inc., which has worked closely with the Corps on several National Great Rivers Museum exhibits and has created museum and heritage center exhibits around the country. It also drew on the expertise of many voices and volunteers, some of whom have taken on the job and expense of educator training.

The non-profit Living Lands & Waters has used its own resources, including a new floating classroom strapped to "garbage barges" used for its famed river cleanups, to hold teacher and student workshops using the "Our Mississippi" curriculum. So far, the group has trained 188 teachers and non-traditional educators in nine workshops, and seven more are scheduled for this year. The Corps conducts additional workshops on its own.

Founder Chad Pregracke, April's CNN featured "hero," says he sees education as a natural extension of his river cleanups and maybe the most effective way to keep the Mississippi clean. Students in Marilyn Beasley's earth science class in Memphis, for example, conducted some hands-on experiments, learned how wetlands filter water and interacted with a commercial fisherman. On-river lessons are the ones that most often stick, he said.

"Honestly, I think it's one of the most comprehensive, well-balanced curriculums that I've ever seen," he said. "It's covered so many different topics, and I think it's the best one that's ever been done, and that's why we use it."

In St. Paul, trainings are being led by Barry Berg, a volunteer with the U.S. Coast Guard Auxiliary. He's now expanding from the training of teachers to include teachers-in-training. His last workshop was for 20 elementary education students at a Twin Cities college. The joint mission of the Coast Guard and Corps is to help instill environmental stewardship into a new generation, and he likes that teaching future teachers can multiply that exponentially.

"That was always a major goal … to present facts to children and young adults so they can investigate on their own and make well-informed decisions."

He says to his 20 students, "Why am I standing here before you, using up a Saturday of my time? Because in the course of your careers, each of you will teach close to 1,200 students. That means today, if I can convince you about the value of the Mississippi River, I can actually touch 24,000 students, and keep touching them long after I'm dead."

—K.S.

Register for workshops at livinglandsandwaters.org or contact the National Great Rivers Museum: 618-462-6979, ngrm@usace.army.mil.

CORPS OFFERS HANDS-ON LEARNING FOR FUTURE SCIENTISTS AND ENGINEERS

By 2020, the U.S. expects more than 2.8 million openings in the fields of science, technology, engineering and math (referred to as STEM) and will need to increase the number of college graduates in these fields by nearly 1 million more to meet the demand. The U.S. Army Corps of Engineers is working to help the country meet that demand by building enthusiasm for engineering and science careers.

An ambitious STEM outreach program at the Corps' Mississippi Valley Division focuses on relationship-building between students and employees of both the Corps and U.S. Coast Guard, another project partner. Partnerships also are forged between students and the Mississippi River itself.

In St. Louis, students have met twice monthly with Corps and Coast Guard ambassadors/mentors. Other projects have brought students on site, for job shadowing at the Applied River Engineering Center.

One New Orleans District program, featured recently in *USA Today*, brought senior engineering students with the Scotlandville Magnet High School Academy of Engineering to the sites of the newly-completed Hurricane Storm Damage and Risk Reduction System. Students networked with engineers and investigated each phase of the design process used to build the world's largest pump station. Students used lessons learned in their own class-related engineering project designs.

Said student Ray Armant: "This was the best field trip that I have ever experienced. I was able to see the application of engineering design and development and how it actually aligns with what we have been learning in our engineering class. The process actually became real to me."

Don't call them 'spoils'

Sediment dredged to keep navigation traffic moving is being repurposed into coastal land and islands in a region sorely in need of some.

As a news camera records the magic, thick slurry flows through a two-mile long pipe and onto a coastal stretch of Plaquemines Parish. What would normally take centuries is being sped up to hours, the newscaster notes, as an island forms before his eyes.

One Louisiana resident on the scene scrawls in the sand the initials "BUDM." In a different situation, initials penned in sand might represent a love interest. This late spring day it symbolizes a different kind of affection—that which most coastal Louisiana residents share for the "Beneficial Use of Dredged Material," a process that proves sexier—and more promising—than it sounds.

How it works is this. Sediment removed during dredging—a federally-mandated process to keep a navigable depth for barges transporting goods to regional and export markets—is used to create almost instant land. The land benefits both wildlife and humans dependent upon the storm-protection buffer and many riches of Louisiana's coastal wetlands. In total, the U.S. Army Corps of Engineers has created some 30,000 new acres through this method.

The process may seem like a band-aid in a region losing a football field worth of land every hour through sea level rise, hurricanes, detrimental human activity and more. At the current rate, the Gulf is predicted to encroach on the land by as much as 33 miles by 2040, resulting in a loss of 800,000 acres of wetland habitat for migrating birds, oysters and many human uses. But when funding is available, there are no apparent losers in a process that keeps the channel open and builds new wetlands.

"I like to call it sediment recycling," said Sean Duffy, Executive Vice President of the Louisiana Maritime Association. "For so many years people called it dredge spoils. It used to irritate me. Those spoils were what built our state. . . Navigation wants material out of the channel, and the best place for it to go is along the coast, trying to replicate what Mother Nature used to do."

FROM TOP: ***Birds flock above new islands and other land created by dredged sediment. A dredge works to create land in a wildlife refuge.***

In all, some 48 percent of all the sediment dredged from the Mississippi's navigation channel is now used in land-building. The Delta National Wildlife Refuge, adjacent to the mouth of the Mississippi, has been the recipient of more than 2,000 acres, including 600 acres added during a recent dredge cycle. That's significant even on a marsh refuse totaling some 48,000 acres, says Neil Lalonde, who manages the Bayou Sauvage, Breton and Delta National Wildlife Refuges for the U.S. Fish and Wildlife Service.

This refuge lies near the Southwest Pass, where ships travel between the Mississippi River and the Gulf of Mexico. Several dredges drop sediment at the Head of Passes disposal area, with a contracted crew then placing the material strategically into the wildlife refuge. Eight million cubic yards of material yields about 500 acres of land.

The acreage gained by the Delta National Wildlife Refuge project has led to an apparent increase in the population of mottled ducks, which live in the refuge year-round, as well as a growth in submerged aquatic vegetation—a key food source for the up to 300,000 waterfowl that winter there, LaLonde said. The refuge is an important nursery area for fish and shrimp, a key resting stop for migratory songbirds and home to rarer species like the piping plover, American alligator and brown pelican. It's also an unusual spot in Louisiana for the way it's concurrently gaining and losing land by forces of nature. The Mississippi River still deposits sediment in the refuge, resulting in land gained. In other parts, storm damage and other causes are turning wetland to open water.

"I definitely think it's a win-win situation," LaLonde said, "for the Fish and Wildlife Service, the waterfowl and wildlife that use this area, and the American public." —K.S.

GROUP PHOTO: LIVING LANDS & WATERS. OTHERS: U.S. ARMY CORPS OF ENGINEERS.

FROM THE PLANNING CHIEF

Gregory Miller, Chief, Plan Formulation Branch, Regional Planning Division—South

Gregory Miller

How have you been involved in the restoration of Coastal Louisiana?
Since 2000, I've helped the Corps plan and build projects in Louisiana. I've led teams that built the West Bay Sediment diversion, replanted dunes and marsh on barrier islands, installed shoreline protection works, and closed a shipping canal. I was also part of a team that completed beneficial use projects on Breton Island, the second-oldest National Wildlife Refuge. My experience in coastal work covers all of our coastal restoration tools.

Why are these projects so important?
Coastal Louisiana is losing an average of 15 to 20 square miles of wetlands a year. That's the country's highest erosion rate. It's important because these are special habitats.

Talk a little about their value.
Coastal habitats are highly productive. They're important as nursery areas for commercially harvested species such as blue crab, oysters, brown and white shrimp, red drum, black drum, speckled trout and flounder. The wetlands are also important for bird species, including some that are intercontinental migrants and endangered species protected by federal law or international treaty. That's the ecological part. There's also economic value. We're at the bottom of one of the largest watersheds in the world with the Mississippi River serving as a key link between America's inland waterborne commerce network and ocean-going imports and exports. Southeast Louisiana's river wharfs form the world's largest port complex. Top commodities passing through the port include agricultural products, coal, steel, rubber, chemicals and forestry materials. The wetlands along the state's coast buffer communities from powerful hurricanes. Finally, the state is important from a domestic oil and gas production standpoint that contributes to our national energy security. That's why stopping land loss matters.

Why is sediment so important in restoration projects?
At the end of the last ice age, glaciers started melting and water runoff moved sediment down the river valley. Those sediments helped form the lands that are now part of what we call Coastal Louisiana and the Mississippi River delta plain. Over time, sediments filled in shallow areas along the coast forming the wetlands that are so valuable to us. Sediment now is the biggest limiting resource on the coast. There are lots of reasons why the coast is eroding, but one of the biggest is the fact that our land is sinking, and the best way to counteract that sinking is to input sediment into the system. We can do it in a number of ways, like the beneficial use of dredged material from the river. Over the past few decades, we have used channel maintenance dredged materials beneficially to restore over 26,000 acres of coastal habitat. But there's no single solution to this problem. You're not going to dredge your way out of the problem or divert your way out of the Louisiana land loss problem. You have to look at it as a system and put multiple projects in place to restore and sustain the ecosystem.

Late-breaking ice

During the bulk of the year, Al VanGuilder surveys the navigation channel for depth to ensure towboats and barges have a 9 foot draft—enough water to make it through the channel safely. Come spring, he conducts the annual ice survey, taking measurements to help determine the "opening day," so to speak, of the spring navigation season. This year's was the latest on record at April 8, when the Roberta Tabor went through Lock and Dam 2 in Hastings, Minn., pushing 12 barges, en route to St. Paul.

Al VanGuilder (in driver's seat) heads out on the annual ice survey. RIGHT: *VanGuilder measures the thickness.*

The Corps' St. Paul District is the only one in the U.S. to conduct ice surveys by airboat. Tell me about them and what you do.

Most of the time, airboats are used for swampy areas like down in Florida or the Gulf. We use it to get around on the ice safely. There are a lot more challenges involved with that since we're dealing with a propelled boat on ice, where it can be very slippery, and we don't have brakes. There are different ways of stopping. Basically, we have to spin around to stop on ice.

How is the surveying done?

We have GPS coordinates of what we call the sail line. When towboats go through Lake Pepin, it's not like a regular navigation channel within the rest of the river system. Barges follow the sail line. We'll use our GPS at each mile marker, determined by our river maps, and drill a hole with an ice auger—a typical one used for ice fishing. Then we have an L-shaped stick we made out of aluminum and attach a stick-on tape measure that we use to get a good reading of the ice thickness. We've been doing it that way for as long as we've been taking ice measurements, which is around 20 years.

How many holes do you drill?

Early in the season when we start, we take 17 measurements on Lake Pepin, each being a mile apart. Depending on weather each year, the upper end or lower end is going to melt away first. Each week, we could lose a mile, or it can stay the same.

Why Lake Pepin?

Lake Pepin is the widest area within our (St. Paul) district. There's very little flow. The water doesn't run very fast through it, so the ice gets a lot thicker and holds the ice longest of anywhere within the entire navigable portion of the Mississippi River. A lot of times we'll get ice more than two feet thick, and it's very difficult for a towboat to make its way through two feet of ice.

What'd you find this year?

This spring was very odd. I'm looking at our totals for the entire season, and there were many times when we gained up to four inches within a two-week period, in late March. That's typically unheard of. The biggest difference that I see here is that we had 19 inches in one place and then six weeks later, we had 26 inches of ice—at the same mile marker. That's unheard of this late in the season. —K.S.

FROM DROUGHT TO FLOOD

Water level swings pose ongoing navigation challenge

...a 45-foot swing in just four months.

As a result of a unified effort between the U.S. Coast Guard, navigation industry and U.S. Army Corps of Engineers, there were no groundings in the navigation channel during extreme low winter water levels on the Middle Mississippi River, and commerce continued unimpeded on the world's largest inland waterway transportation system.

Ironically, it was the high water that followed that ended up delaying river transportation during peak flooding when several locks had to be temporarily closed to navigation traffic, temporarily affecting the movement of agricultural and other products. On Jan. 1, the water level on the Mississippi River gauge in St. Louis read 4.57 feet below the gauge; in mid-April, it reached 39.4 feet above the gauge—a 45-foot swing in just four months.

The highly publicized removal of rock from the navigation channel near Thebes and Grand Tower, Ill., dubbed Operation Rock Out, was completed on Feb. 27. The rock was part of a large formation that posed a danger to navigation during low water. Around 1,000 cubic yards of rock was removed from the river by excavation and blasting.

"It took a tremendous team effort to keep the river open," said Maj. Gen. John Peabody, Mississippi Valley Division Commander. "We now have permanent improvements to the navigation channel and stronger relationships between the Corps and our industry partners."

During the lowest point of the drought, the Corps deployed as many as 25 dredges to maintain the Mississippi River's navigation channel and re-open sand-choked harbors between St. Louis and the Gulf of Mexico.

Beginning in May 2012 and ending February 28, 2013, the Corps and private contract dredges worked around the clock, seven days a week, to remove sediment deposited by the 2011 flood and fight extreme low-water conditions. During that ten-month period, the dredges moved more than 29 million cubic yards of sediment—enough material to fill 1,333,333 dump trucks, or more than six Louisiana Superdomes, with a weight (67 billion pounds) equal to 92 Empire State Buildings. Dredge crews labored for up to 30 days straight without missing a 12-hour shift, working through the Thanksgiving and Christmas holidays. —M.P.

MY MISSISSIPPI

Eric Ziino, 17, Godfrey, Ill., once young volunteer, now Student Park Ranger, National Great Rivers Museum

"As a young child, I always went duck hunting on the river. And then having family members working for the Corps of Engineers, you grow up going to river sites, going to locks and dams, and even being on towboats.

"My mother was the first team leader at the museum (opened 10 years ago). She helped design it, and she used me and my older brother as guinea pigs on different exhibits. Basically, she wanted to design a museum that her kids would want to keep coming back to!

"They would call me for events to be the Eagle mascot, which they eventually named after me—Eric the Eagle. Because we couldn't talk, we had to communicate with kids using hand gestures or sign language. It was very hot in there. There was a little fan in the head run by a 9-volt battery, but it didn't do much.

"Visitors who come from all across the country during eagle season are just amazed at how big the real ones can be. I tried to be as accurate as possible with movement. When I stopped being the eagle and became the assistant ranger who'd walk around with it, I finally had the opportunity to talk to people about how eagles act, their eating habits and the migratory flyway.

"What really shocked me is that not many people know what opportunities the river has. Now, I do public events where we can get people out onto the river to paddle or just be right next to it. Then they can see its beauty."

‘Tom and Huck’ float the river, Ivy League–style

MOST BOYS WHO GROW UP NEAR THE MISSISSIPPI, aspiring to meander down the river like Tom Sawyer or Huck Finn, forego those imaginings for adulthood, stepping not onto a rickety raft but the solid footing of a career, constricting as it is.

So imagine Jackson Dobies’ amazement when, via an email, he learned that his college, Princeton University, offered $4,000 awards to students who sought a summer adventure—perhaps their last one.

“It sounded like it was written right to me,” Jackson says of that email. “My older brother had talked about traveling the river since he was very young, and I always thought it’d be cool but never figured out how it would actually happen.”

The Princeton grant, called the Martin A. Dale ’53 Summer Award, offers money for projects that “provide important opportunities for personal growth, foster independence, creativity and leadership skills, and broaden or deepen some area of special interest.” It would fund the Dobies brothers’ seven-week, 1,700 mile journey down the river of their youth.

Jackson, then 20, was approaching his junior year as a classics major at Princeton. Justin, two years older and a fresh graduate of Yale, thought about moving to New York City to pursue an acting career. But in the summer of 2012, they bought a 35-year-old pontoon boat ($1,200) and equipped it for cooking and sleeping (atop two chests they called “our coffins.”) They launched near their hometown of Edina, Minn., bringing with them about three dozen books, most of them classics. That was Jackson’s proposal for the grant: to raft down the Mississippi reading great American literature.

The Ivy League pair called themselves “The Boy Castaways” in their Internet photo album, and felt both as free—and as fretful—as Mark Twain’s river-rafting boys. “Honestly,” recalls Jackson, “from the beginning, because we had motor trouble early on, there was a constant knot in my stomach.” That first trouble came just after their first night on the river, near the River Grove Harbor marina, where they pulled in for help from a man who fixed the motor and waved away their cash.

Six days in, that motor (circa 1981) ignited and burned away. When they called their parents to buy and deliver a new one, they realized they were just a two-hour drive from home, having putted along at only 15 miles a day.

The new motor sped them up to sometimes 100 miles daily. They traveled from dawn to dusk, alternating at the wheel each hour, reading in between, talking about what they read and about topics both weighty and flighty. Between them they finished 21 books. Only once did they argue, so loudly they figured folks on the banks would scratch their heads over two guys on a drifting pontoon screaming at each other over....well, neither can remember.

Mostly, though, they bonded, marveling at the kindness of the folks they met. People fed them and lodged them, let them borrow their cars, gave them advice and continually wished them well. “That’s something I want to remember,” says Jackson. “If there’s any way I can help a young person who’s trying to do something, I want to be an encourager to them.”

South of St. Louis, they fought off jumping carp at every stop, one brother steering, the other wielding an oar. In the evenings, they relished the sandy shores they found on the lower river. “Neither of us is a smoker,” says Justin, “but pretty regularly we’d drink some tea and play chess and smoke the corn cob pipes we bought, or sit on top of those dunes under the moon before we went to sleep, rocked by the waves of the night barges.”

By the time they reached New Orleans, they were wiser young men. Sometimes now, Justin says, he wakes up in the night laughing about the carp, and has to awaken his brother with a call: “Dude! Do you remember how nuts that was?” And Jackson is not annoyed but grateful to his brother, to Princeton, to great books and to the river. —S.A.

RIVER TOUR PHOTOS: COURTESY JACKSON DOBIE.

THE BOOKS THEY READ

JACKSON

- *The Courage to Create*, Rollo May
- *The Book of Basketball*, Bill Simmons
- *Wild at Heart*, John Eldredge
- *This Side of Paradise*, F. Scott Fitzgerald
- *All the Pretty Horses*, Cormac McCarthy
- *Peace Like a River*, Leif Enger
- *All the King’s Men*, Robert Penn Warren
- Various books of the Bible

JUSTIN

- *Adventures of Huckleberry Finn*, *The Adventures of Tom Sawyer* and *Life on the Mississippi*, Mark Twain
- *Lord of the Flies*, William Golding
- *Nineteen Eighty-Four*, George Orwell
- *Fahrenheit 451*, Ray Bradbury
- *On the Road*, Jack Kerouac
- *Walden*, Henry David Thoreau
- *Catch-22*, Joseph Heller
- *Blood Meridian*, Cormac McCarthy
- *The Sun Also Rises*, Ernest Hemingway
- *The Prophet*, Kahlil Gibran

LAUNCH YOUR OWN RIVER ADVENTURE

The Mississippi River Water Trail is a great place to start. The 121-mile trail stretching from Saverton, Mo., to St. Louis, Mo., was officially dedicated in mid-May as a national water trail. The Open River portion of the trail, from St. Louis to Cairo, Ill., is slated to open in spring 2014. Find upcoming events and information on paddling stretches, camping, safety guidelines and much more at **greatriverwatertrail.org.**

DNA potentially seeps into water from a dead silver carp on a barge.

Advancing the science of Asian carp detection—with a little help from some birds

The DNA of Asian carp can survive for days in unexpected places—fishing nets, boat decks and bird droppings among them. That's what researchers have learned so far in an ongoing study of environmental or eDNA, a genetic marker used to identify a given species. And why that matters is this: A positive test for eDNA has previously been assumed by many to be coming from live fish, calling for expensive eradication measures.

"Use of eDNA is a really sensitive tool," said Kelly Baerwaldt, U.S. Army Corps of Engineers Fish Biologist and eDNA Program Manager. "We're saying, 'It's really valuable. We just don't know how to use it yet.'"

Federal agencies have relied extensively on this relatively new science to track the spread of the invasive Asian carp, particularly as established populations move from the Mississippi River toward the prized fisheries of Lake Michigan. Attention recently has also shifted to the more pristine upper stretches of the Mississippi, where carp populations have not yet been established.

> "We found a lot of sources that indeed can be vectors of DNA other than live fish."

The eDNA of bighead and silver carp—two varieties of so-called Asian carp—has been picked up in spots above an electric barrier put in place to prevent their spread. However, no live fish of those species have been captured or observed above the barriers, even after hundreds of interagency monitoring trips. In 2011 and 2012, that monitoring included 192 hours of electrofishing and 81.7 miles of netting. Some 100,000 fish of 65 species were collected, but not a single Asian carp. That led researchers to speculate that something other than live fish could be triggering the results, Baerwaldt said.

Seven laboratories around the country participated in some aspect of a study on eDNA vectors or sources, along with three agencies: the U.S. Army Corps of Engineers, the U.S. Geological Survey and the U.S. Fish and Wildlife Service.

One experiment targeted the potential spread of Asian carp DNA via the many fish-eating birds found frequently around the electric barrier, in particular pelicans, eagles and cormorants. Researchers teamed with zookeepers to feed silver carp to pelicans, then tested for eDNA in their regurgitation and excrement. Study findings showed that silver carp DNA was present in bird droppings and could be detected up to a week following the silver carp meal. Researchers also put those droppings on metal sheets and exposed them to the sun, replicating a boat deck, and found that eDNA could be detected for 30 days despite exposure to temperatures up to 140 degrees.

In other research, satellite-tagged double-crested cormorants were tracked. Researchers found that some traveled as far as Canada or the Gulf Coast. Thirteen of 15 cormorants tagged tested positive for Asian carp DNA.

"We found a lot of sources that indeed can be vectors of DNA other than live fish," Baerwaldt said. "I think the bird findings were among the most interesting."

The continuing study will now examine how long eDNA takes to degrade and apply those findings to a probabilistic model that could predict the chance that a given reading came from a live fish versus one that was a long-ago cormorant lunch.

"Our goal is to make this relatively young and complex monitoring tool the most effective to detect live Asian carp and to provide real, tangible and empirical data to the resource managers, so they can make informed decisions, perhaps for response or other management efforts," said Baerwaldt.

Once the calibration tool is perfected, she said, it can be applied to any threatened and endangered species sampling of any rare population.
—K.S.

For complete study results and more on Asian carp eradication efforts, go to asiancarp.us

STUDY FINDINGS AT A GLANCE

Researchers looked at potential means by which Asian carp DNA could get into a water source and appear to be coming from live fish. Here is some of what they found.

Storm Sewers

eDNA deposited into storm sewers during experimental trials largely dissipated in the river within a day.

Fisheries gear

Vessel hulls have considerable amounts of adhering DNA, which can persist for days and is not removed by overland transport. Adhering DNA also does not appear to be completely or quickly washed off of boats moving through the water. Thus, vessel hulls can be vectors for DNA movement. Nets appear to be sources of very large amounts of eDNA.

Bird Transport and Deposition of DNA

Silver carp DNA was detected in fecal samples collected from fish-eating birds offered 1-3 meals of silver carp; silver carp DNA could be detected in bird fecal samples collected up to one week following silver carp consumption. Silver carp DNA in fecal material deposited on metal sheets persisted for 30 days despite exposure to temperatures exceeding 60°C (140°F).

Fish Carcasses

Silver carp DNA can be detected for at least 18 days when the surface of carp carcasses or water that had flowed over those carcasses was sampled. These trials indicate that carcasses, rain or other run-off from surfaces where Asian carp carcasses or slime residue reside, can be a source of DNA entering a system.

Barge Transport of Carcasses

During the 2012 shipping season, there were three reported incidents of five Asian carp carcasses on vessels.

Sediments

Five of 13 stream bank samples taken approximately 105 km downstream of Lockport, Ill., on the Illinois River tested positive for silver carp DNA; bighead carp DNA was not detected. Sediment samples were collected from Lake Peoria dredged materials. Eleven samples tested positive for silver carp DNA, and one sample tested positive for bighead carp DNA.

BARGE PHOTO: MATTHEW SHANKS, U.S. ARMY.

River mayors put the Mississippi center stage

When a dozen river-town mayors traveled to Washington D.C. earlier this spring, they brought the Mississippi River with them, so to speak. They conducted meetings with legislators and federal agencies atop a room-sized map of the Mississippi, along which were placed striking photos from the particular river stretch. And the symbolism was fitting. The group went to Washington to participate in the formation of a first-ever Mississippi River caucus, a bipartisan, bicameral group that includes two senators and four members of Congress.

The goal of the caucus is to speak for the needs of the entire river, not the more limited needs of each caucus member's geographic focus. That in itself made a powerful statement, said Vicksburg mayor Paul Winfield, one of the delegation members.

"We're always stronger when we work together," he said. "If we continue to focus on our mutual interests, we'll be a force to reckon with as we continue to push for the river and her maintenance."

The mayors presented their river agenda to legislators, a list that includes a heavy focus on prevention of invasive species, a comprehensive farm bill, improvements to aging lock and dam infrastructure and more.

The group also met with generals from the U.S. Army Corps of Engineers, the agency with jurisdiction over many of the river's navigation and ecosystem restoration resources. The agency has faced unprecedented challenges recently, including a swing from the largest recorded flood in history to its worst drought and the related challenges and costs.

At a joint dinner, the mayors offered to be a voice for overcoming challenges the Corps and other agencies face in managing the waterway. Memphis Mayor A.C. Wharton proposed a formal memorandum of common purpose to further cement the relationship. While a formalized partnership beyond the caucus—with the U.S. Army Corps of Engineers—is only a notion at this point, it demonstrates motivation by both groups to pursue a formal alliance, said Colin Wellenkamp, director of the Mississippi River Cities & Towns Initiative. The group's main goal is to elevate the Mississippi on the federal agenda.

Perhaps the first evidence of success will come if the river ends up being represented in the recently introduced Water Resource and Development Act. The bill's first draft makes no mention at all of the Mississippi, but does include several other rivers.

The mayors have started the dialogue, telling the river story to the many lawmakers eager to listen. As the ecological linchpin to the 37-state Mississippi River Basin, the group noted, the river is responsible for creating $105 billion worth of U.S. GDP; providing drinking water for more than 18 million; transporting 62 percent of our nation's agricultural output; delivering nearly 400 tons of coal and petroleum products; and directly supporting one million jobs and millions more indirectly.

ABOVE: ***Legislators and other dignitaries mingle atop a giant map of the Mississippi River during the announcement of the first-ever Mississippi River Caucus.*** BOTTOM: ***A sampling of a Mississippi River photo exhibit displayed on Capitol Hill.***

What has already drawn notice is the way the entire river representation has come together in the initiative.

"For so long, they've been used to regional conversations, the northern stem, the middle, the southern stem," Wellenkamp said of legislators. "To all of a sudden see dozens of mayors come together around a river that's 2,320 miles long and involves so many different sectors of the economy—recreation, agriculture, energy—it's been striking to people. We know because they told us." It's been obvious to people that have met with the mayors that they are really serious about this. Whatever differences they have, they really are setting them aside and cooperating for the entire waterway.

Mayor Winfield said he has learned more than expected about the diversity of the massive river system as he travels to visit other river town mayors and sees the way some are more impacted by its recreation and natural beauty, others by the commerce it carries.

"It's awesome to realize that one body of water has such a great impact on all our communities," he said. "On a lighter note, all of us mayors are joking about who has the best tasting water." —K.S.






The Invisible Invertebrate

Don't underestimate the importance of the river's tiniest residents.

MOST ARE RARELY SEEN, staying camouflaged in their preferred homes—the clay, mud, leaves, fallen trees or shifting sand at the bottom of the Mississippi River.

But invertebrates from pupal midges to whirring dragonflies might be more important than anyone knows to the ecosystem of the Mississippi, both as the base of the food web and a measurement of river health, according to researcher Audrey Harrison-Lewis.

An expert in aquatic insects, Harrison-Lewis made some discoveries about the Mississippi's invertebrates while conducting research for the Corps' Engineer Research and Development Center's fish ecology lab. As she launched a research study into the preferred diet of the endangered pallid sturgeon, she quickly realized how much is yet unknown about the invertebrate fauna of the Mississippi River—such a large system, she says, that it had for the most part been written off as a place untouchable for aquatic entomologists.

"Usually they study streams and lakes and small rivers you can wade in," she said. "The Mississippi is not wade-able. Also, the Mississippi for a long time has been looked at as a place where there's not a whole lot of habitat complexity. That's not the case… It's an amazing place and deserves more attention, more research."

Instead of wading her way to her specimens, Harrison-Lewis found hers in the tummies of sturgeon collected for research. What was most surprising, she said, was not how much she could learn about the fish based on what they were eating, but what she learned about the Mississippi based on the fish's diet. She's already discovered 10 new groups of species (or "records") never reported as being found in the Mississippi, in some cases because humans have a hard time getting into the sandy substrates where those species live.

"Fish, however, were excellent samplers of them," she said, "so we were able to see the complexity of what is on the bottom of this great river and what fish eat on a daily basis."

Scientific literature lists 215 known invertebrate species in the Mississippi River; Harrison-Lewis suspects, based on what she found, there could be at least 100 more not yet discovered. During her laboratory research, she found 40 different insects in the pallid sturgeon diet, along with crustaceans and other non-insects. The preferred diet fell mainly into a subgroup of one family of flies, the *Chironomidae*, that specializes in living in shifting sands. The sturgeon acts as a vacuum cleaner of sorts as it floats along the ridges of the underwater dunes.

Among her favorite finds is the *Pseudiron centralis*, not previously thought to live in the Mississippi. The tiny mayfly curls its body into an upside down U-shape to create a vortex of water in front of its mouth as a way to feed. By doing this, it uncovers its prey, which are burrowers in the sand. It's so rarely collected that several professors have asked to borrow her specimens for their courses.

Knowing the preferred habitat of sturgeon food sources helps resource managers make predictions on where rare sturgeon are going to feed. The next step of the research is to go into both main and side channel habitats for sampling, find out what's there and learn more about what the benefits of such a diverse invertebrate fauna might be.

"It's such a unique field of study," she said, "because each stream or body of water contains a completely different suite of insects—those differences and life histories offer so many keys to water quality and ecosystem health." —K.S.

Aquatic Insect Examples

Chironomidae

Family of flies called midges that spend the larval and pupal portions of their lives underwater and their adult lives on land and in the air. Some burrow into the sediments, some cling on to hard surfaces and plants, and some live on other animals like mussels and snails. They not only process organic matter, they also serve as food for other animals such as fish and other invertebrates.

BELOW, FROM TOP: ***Head of Cryptochironomus sp.; Robackia claviger.*** PHOTOS: A. HARRISON-LEWIS

Pentagenia vittigera

This fascinating mayfly species burrows into clay banks in large rivers during its larval stage. When water levels are low and the clay banks are exposed, the burrows look almost like honeycomb. PHOTO: AMY MEIER (MDC)

Pseudiron centralis

This mayfly species sprawls on unstable sandy substrates and has a unique feeding habit during its larval stage. It contorts its body into a position that changes the way the water flows over it, creating a vortex in front that uncovers its prey items, which are predominately chironomids buried in the sand. PHOTO: RANDY MANDRYK. ©2013 UNIV. OF ALBERTA

Hydropsychidae

Members of this family of caddisflies are called "net-spinning caddisflies." These interesting insects live underwater during their larval and pupal stages and build nets out of silk to capture particles to eat out of the flowing water. They are very common in the Mississippi River and are a very important food item for many fish.

BELOW, FROM LEFT: ***Hydropsychidae larva. Photo by State Hygienic Laboratory (University of Iowa); Hydropsychidae net.*** PHOTO: D. BRUSCO

DID YOU KNOW? A recent aerial count by Audubon Minnesota found 38 active bald eagle nests, two more than last year, within the Mississippi River Recreation Area, 32 of them in tall trees between Hastings and St. Paul's Pigs Eye Lake. SOURCE: STAR TRIBUNE

EAGLES: WIKIMEDIA COMMONS.

War College strategy exercise features realistic river flooding scenario

A combination of heavy rains and the rapid melt of a late snow pack formed one of the scenarios faced by strategists who gathered at the Maxwell Air Force Base in Montgomery, Ala., last month. Various states were declaring emergencies, some of them requesting federal help to evacuate residents in low-lying areas along the Mississippi and the Red River of the North.

How the national disaster response framework could help was the focus of this virtual scenario played out by students from U.S. Army War College as it conducted its annual Joint Land, Air and Sea Strategic Exercise—ironically, the same week the same scenario appeared to be unfolding along the same rivers and impacting the same states. Several locks and dams were forced to close due to flooding concerns and the river overtopped levees, flooding surrounding farmland.

"We've been making a joke that next year we don't want to create those scenarios; they're too close to actually happening," said Col. Karl Bopp, one of the faculty advisers for the exercise.

The Joint Land Air and Sea Strategic Exercise plays out over several months. The project lets students—most of them colonels headed for work at the Pentagon or other senior positions—play the role of strategic leaders seeking to solve problems relating to national security policy, strategic objectives, resource prioritization and the government's approach to crises that might include natural disasters.

War College students play the roles of National Security Council members briefing the President on events that include flooding in the Northern Plains.

This year's work culminated in the mid-April joint exercise with the other senior-level colleges, some of which were simulating war-related scenarios on foreign soil. The defense department's response was coordinated by students from the Marine Corps War College, who role-played senior leaders within the U.S. Northern Command.

This is the first time the annual exercise used a flooding scenario. The Army War College formed a new seminar team to serve as officials within the Department of Homeland Security or FEMA for the exercise. Those students learned how policy and strategy are formulated by groups outside of the Department of Defense and were able to see the required coordination from a new perspective. The Department of Homeland Security seminar team had to face a multitude of problems that ranged from a potential flu epidemic to terrorist attacks within the United States. Facing the imaginary flood in spring 2023 required the students to draw on critical background information from the unprecedented 2011 Mississippi River flood.

By the time students reached the Alabama air force base, home to each year's joint exercise, the virtual flooding had already occurred, Bopp explained. One student, portraying a FEMA official, flew (literally) into the base by plane to be met—and grilled—by a mock television crew. Teaching future strategists to communicate clearly during natural disaster was one exercise objective.

The students learned how to position resources to get in front of the problem.

Other lessons focused on the relative role of state, federal and local governments and agency partners in a flood response situation. What should a federal official do, for example, if state assistance is clearly needed but the given state hasn't yet requested help? The students learned how to position resources to get in front of the problem.

No students played the Corps of Engineers officers operating the flood control system, he said. But background provided by Corps employees provided critical information, and the exercise was helpful in training future officers who may be placed in such a position. The Corps-produced "Room for the River" summary report of the 2011 flood was given to students as a study guide.

"I'd just like to thank the Army Corps of Engineers for the information they provided," Bopp said. "The folks I talked to at the Corps were very helpful and knowledgeable, and we look forward to collaborating with them on future scenarios like this one." —K.S.

PHOTO: U.S. ARMY WAR COLLEGE.

MY MISSISSIPPI

Sharon Day, founder, Mother Earth Water Walkers, St. Paul, Minn.

"Two years ago, there was something called the Mother Earth Water Walk. We brought saltwater from four oceans to the heart of Turtle Island, what we call Lake Superior. We wanted the waters to know we're thinking about them, we're praying about them. On the eagle feather staff we carry, I had carved the Mississippi River. I looked at that every day, and thought: 'Why not walk the Mississippi River, take that clean, pure water from the source of the Mississippi where we can drink the water all the way down to the mouth and give the river a taste of herself—how she was in the beginning and how we wish for her to be again.'

"The basis for the walk (completed in early May) is spiritual. But it's also to get people to recreate a relationship with the water. The river, she is a living entity. When you think about the earth, the river is like a main artery. If she gets polluted and clogged up, what happens to humans when that happens? So we want to raise awareness that the river didn't pollute herself, we do that, all of us. And we all need to be part of the solution."

Stimulus-funded lock project improves safety, beautifully

To see the "concrete" benefits of stimulus funding, look no further than the Lock and Dam #3 Navigation Safety and Embankment Improvement Project.

The project is the largest American Recovery and Reinvestment Act Project within the Mississippi Valley Division, with $60.7 million of the $69.3 million construction cost coming from the nation's investment in aging transportation infrastructure.

"Getting the [stimulus] money up front made a big difference in the way we executed this project," said St. Paul District Project Manager Tom Novak. "In fact, this is the first design-build project in St. Paul District history, and we finished under budget."

Construction on the lock and dam, located six miles north of Red Wing, Minn., took place during the winter months to avoid impacts to navigation. It was necessary to reduce the possibility of damage to the lock by barges. Previously, low and weak embankments on the Wisconsin side also created problems. Failure of the embankment system could have resulted in significant economic and environmental consequences.

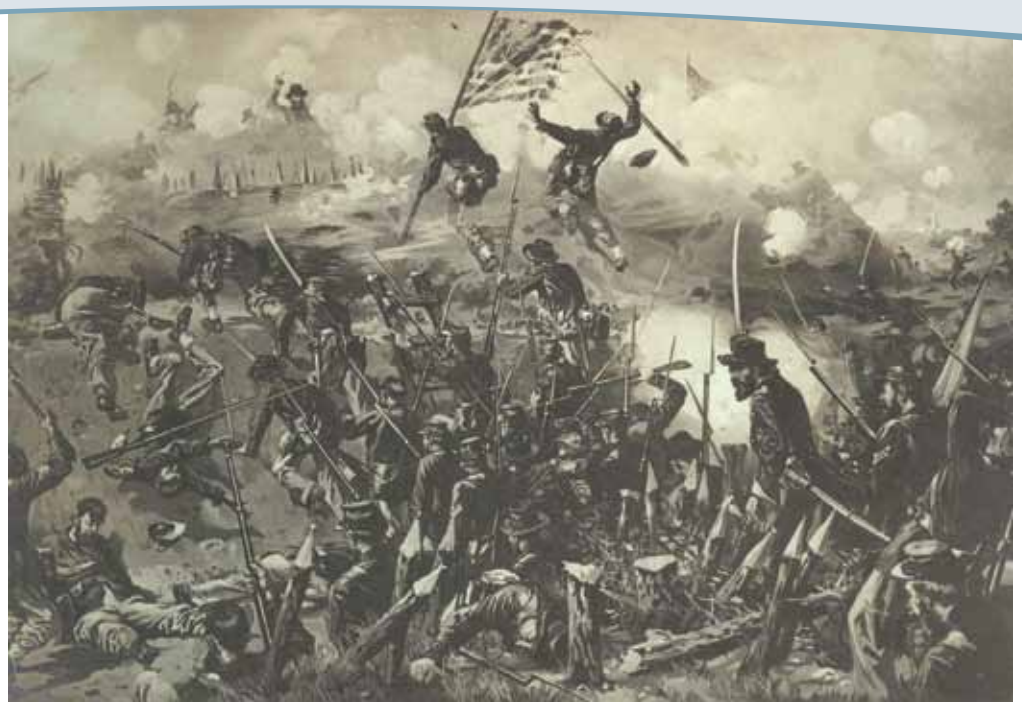
The project navigation improvements included extending the upper guide wall by 862 feet, adding a closure dike to reduce outdraft conditions along the guide wall, and using 150,000 cubic yards of dredged material to build up the project's contours. The new contours mimic the natural shoreline of a river island.

The lower embankment improvements included the construction of a series of spillways totaling several thousand feet along with associated control structures. Upper embankment improvements included the reconstruction of nine channel closures along the Wisconsin side of the river. The project also restored 313 acres of floodplain. —R.A.

OUR MISSISSIPPI TRAVEL

Not-so-Civil War remembered

Control of the Mississippi during the Civil War was a priority for both the Union and Confederate forces. Battles waged along the river from St. Louis to New Orleans, but it would be the Siege of Vicksburg in Vicksburg, Miss., that would serve as the turning point in the war.



Siege of Vicksburg: Assault on Fort Hill ***by Thure de Thulstrup, 1883.***

By spring 1862, the Union Army had successfully captured both Memphis and New Orleans, leaving Vicksburg as one of the last Confederate strongholds along the Mississippi River. Called the "Gibraltar of the Confederacy," Vicksburg was strategically located on high bluffs and positioned along the Mississippi River as to make attack from the water extremely difficult. However, the use of steam-propelled warships, or ironclads, had already transformed the way battles were fought.

One such ironclad was the USS *Choctaw*, which fought along the Mississippi River and her tributaries from April 1863 to May 1864. Built in Indiana in 1853, the *Choctaw* was the first U.S. Navy ship to be named after the Choctaw Indians. (Four others have since been named). The 1,100-ton steamer was more than 210 feet long, could carry a crew of approximately 106 soldiers, and was called "Monster" due to its odd shape and large size.

Used as both a gunboat and ram, the *Choctaw* supported Maj. Gen. William T. Sherman's initial attack on Vicksburg. Although the attack was unsuccessful, it occupied Confederate forces while Maj. Gen. Ulysses S. Grant crossed the river below Grand Gulf, Miss. This crossing was followed by several battles, which resulted in the capture of the state capitol in Jackson, Miss., and the eventual Siege of Vicksburg.

A few weeks before the Siege of Vicksburg, the USS *Choctaw* was stationed along the banks of Vicksburg. A June 18, 1863 letter from Navy Landsman Daniel Francis Kemp describes the days before the famous battle:

> *"The river is very narrow in front of Vicksburg and our pickets are on one side and the rebels on the other. They are constantly firing at each other. If a soldier on one side goes down to the water to fill his canteen he is fired at by someone on the other side. I went down to the levee in front of Vicksburg and had a fine view of the city. There are millions of blackberries in these woods along the levee. I used to go after them everyday [sic]."*

During the spring and summer of 1863, Vicksburg homes were being taken over for make-shift hospitals and command centers, food and resources were in short supply, and the sounds of artillery echoed throughout the city. The increasing presence of ironclads and news that Union forces were winning battles in Jackson, Miss., forced local residents to take cover in local caves. Ms. Mary Loughborough, wife of Confederate officer Maj. James M. Loughborough, described life in the caves with her two-year old daughter in the 1864 *My Cave Life in Vicksburg*:

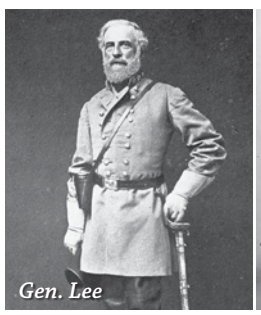
> *"The caves were plainly becoming a necessity, as some persons had been killed on the streets by fragments of shells … Our new habitation was an excavation made in the earth, and branching six feet from the entrance, forming a cave in the shape of a T. In one of the wings my bed fitted [a narrow spring mattress camp bed]; the other I used as a kind of dressing room; in this the earth had been cut down a foot or two below the floor of the main cave; I could stand erect here; and when tired of sitting in other portions of my residence, I bowed myself into it, and stood impassively resting at full height-one of the variations in the still shell-expectant life … We had our roof arched and braced, the supports of the bracing taking up much room in our confined quarters. The earth was about five feet thick above, and seemed hard and compact …"*

On July 4, 1863, Lt. Gen. John C. Pemberton surrendered to Maj. Gen. Grant. The city lay in ruins and more than 19,000 Union and Confederate soldiers perished during the Vicksburg Campaign from March to July 1863. With the taking of Port Hudson, Miss., a few days later, the Mississippi River was under Union control. The successful Vicksburg Campaign, along with the recent Union victory in Gettysburg, would ultimately prove to be the downfall of the Confederate Army. The legacy of the fighting in Vicksburg continues to define this city along the mighty Mississippi. The Vicksburg National Military Park welcomes more than a million visitors every year and hosts several reenactments and interpretive events. Monuments, cemeteries, earthen mounds and other remnants of the Civil War can be seen throughout the city.

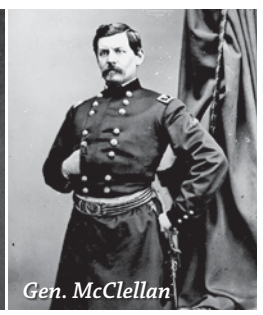
Author Sarah Koeppel is an archaeologist with the Vicksburg District, where she works on prehistoric and historic sites, consults with Tribal Nations, and ensures the Corps is in compliance with cultural resources laws.

Memorial Day weekend starts the official commemoration of the 150TH anniversary of the Siege of Vicksburg. Find more information about Vicksburg National Military Park and the National Park Service's 150TH anniversary commemoration of the Civil War at www.nps.gov/features/waso/cw150th/index.html.

DID YOU KNOW? Steamboats carried soldiers and supplies up and down the Mississippi. The steamship *Sultana* was licensed for 350 passengers on a fateful voyage in 1865 when 2,134 Union soldiers returning from Confederate prison camps were given a ride upriver. Traveling too fast with too heavy a load, the steam boilers exploded. The death count was 1,700—the worst ship disaster in U.S. history.



Gen. Lee



Gen. McClellan

The Army Corps in the Civil War Engineers played vital roles during the Civil War. Schooled at West Point, Union and Confederate Army Engineers focused on the construction of forts, embankments, bridges and floating pontoons, railroads and canals. They also assisted with the demolition of opposing forces' supply lines.

After the Civil War ended, the Corps Engineers helped with reconstruction efforts, which included improving navigation for commerce. Their success and reputation led to the Corps of Engineers becoming involved in flood control in 1879, with the creation of the Mississippi River Commission.

Noteworthy Generals George McClellan and Robert E. Lee were both graduates of West Point who served as engineers in the Army. —S.K.

EXPLORE THE WAR

Vicksburg, Mississippi

The Siege of Vicksburg still echoes in this Mississippi town rich in Civil War history. The mightiest river defines this "Key to the South," so termed by President Lincoln, as Vicksburg sat high upon the bluffs of the Mississippi River at a hairpin turn with a crucial vantage point that made it a necessary conquest. Vicksburg still lives and breathes its wartime memories with its 118-acre National Cemetery, the National Military Park and numerous museums. The Old Courthouse Museum is an architectural marvel housing war artifacts and memorabilia. A meticulously crafted diorama lays out the battlefield of the Siege of Vicksburg at The Old Depot Museum. Stroll along the Yazoo Diversion Canal to view murals depicting Vicksburg's history and culture painted on the panels of the floodwall. Tour the elegant, beautifully preserved mansions of cotton and lumber aristocrats. This June and July, Vicksburg National Military Park hosts the interactive traveling exhibit "Lincoln: The Constitution and Civil War Exhibit."

Corinth, Mississippi

Corinth, where the rail junction connected the North and South, became a critical Confederate loss in 1862. Corinth is now home to one of the most modern National Park facilities. Many of the Civil War–era buildings still stand, including stately homes of commanding generals. Tours include the premier attraction, the Corinth Civil War Interpretive Center, where outdoor pathways feature bronze statues reflecting the aftermath of this bloody battle, and multi-media presentations detail the Battle of Shiloh and the Battle of Corinth. Once Corinth became a federally occupied state, it was a haven for slaves escaping Southern plantations. Walk the path of early freedom at the Corinth Contraband Camp to witness the desperate lives of these slaves, considered "contraband" of war. At Corinth's Civil War Earthworks, see how man moved earth to provide protection by building walls, rifle pits and forts that stand today as remarkable exhibits. CORINTHCIVILWAR.COM.

Jackson, Mississippi to Chattanooga, Tennessee

In September 2013, American Experience and Artful Travelers presents "A Civil War Journey." This 12-night voyage on the beautifully refurbished *American Queen* Steamboat celebrates the acclaimed PBS productions, "Death and the Civil War" and "The Abolitionists." Noted Civil War historians participate in presentations, discussion panels and shore excursions. ARTFULTRAVELERS.COM —A.H.

SULTANA: AND AMERICAN QUEEN: WIKIMEDIA COMMONS.

OUR MISSISSIPPI KIDS
sketching nature

Go outside and find an example of each, then sketch it in the box. Pay close attention to the details!

LEAF: How many veins are on the leaf?	**BUG:** What body parts does it use to get around?
WATER BIRD: How do its feet help it move through the water?	**SOARING BIRD:** What helps it catch its food?
AMPHIBIAN: Does it blend in with its environment to stay safe?	**WILDFLOWER:** Use crayons or colored pencils to try to match its color.
WATER PLANT: Does part of it float? Draw the parts that are underwater, too.	**ROCK:** Has it been smoothed by the river?

Get your Corps nature kit and go on a sketching adventure!

The U.S. Army Corps of Engineers Mississippi River Project has created a **Nature Backpack Program** in an effort to give children an opportunity to learn more about the natural world. The nature backpack contains binoculars, a nature book, bug boxes and a magnifying glass. It also includes coloring and drawing pages, word finds and crossword puzzles.

Anyone can check out a backpack for the day. For more information, contact one of the following project offices: Dubuque Ranger Office, 563-582-0881; Thomson Ranger Office, 815-259-3628; Mississippi River Project Office, 309-794-4526; Mississippi River Visitor Center, 309-794-5338; Muscatine Ranger Office, 563-263-7913; or Quincy Ranger Office, 217-228-0890.

Our Mississippi

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Since 2010, we've worked to improve our coverage of the river and its people, from the headwaters to the Gulf of Mexico. We promote the sustainable use of the river through balanced articles about river science, economics and innovative partnerships. We also aim to connect people to this national river treasure with articles on travel and nature, our kids' page and "My Mississippi" profiles about people's creative connections to the river.

How are we doing? Please help us improve by taking our online survey. We particularly welcome your ideas on topics we might cover in the future. Please visit this link to share your thoughts:

https://www.surveymonkey.com/s/OurMiss2013

Arrow Island, in the Mississippi River between Illinois and Iowa.

Scan here with your smartphone to go to the *Our Mississippi* website. Here, you can subscribe to our e-edition, read past editions and find river-related education materials.

Send story ideas to editor@ourmississippi.org

Our Mississippi

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