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A Little Help From Its Friends...

"We have seen nothing like this river that we enter, as regards to its fertility of soil, its prairies and woods, cattle, elk, deer wildcats, bustards, swans, ducks, parroquets and even beaver."

That was how explorer Jacques Marquette described the Illinois River valley in 1673 – it's a different story today, writes John Martin...

Settlers gradually altered the Illinois River watershed, bringing about major changes in hydrology and land use as they built agricultural levees on much of the river's floodplain, converting wetland wildlife habitat to farmland.

In 1900 a channel was cut connecting the river to Lake Michigan that allowed Chicago to divert its wastewater to the river instead of the Lake, which is its drinking water source.

Today, a series of locks and dams completed in the late 1930s maintain a 3km deep navigation channel and the resulting Illinois River and Waterway extends 536km, connecting Lake Michigan at Chicago with the Mississippi River at Grafton near St. Louis.

As It Is

The river valley contains about 60,000 acres of backwater lakes and side channels that have lost much of their usefulness as habitat for fish, waterfowl and other flora and fauna due to accumulated sediment.

Hunting, fishing and such other recreational uses as boating and bird watching have also suffered – hundreds of acres are now permanent mudflats and areas where water was once over two metres deep now average just 30cm ... and contain about 380,000,000m3 of sediment.

The removal of a significant fraction of this material is necessary to restore the river ecosystem, but large-scale restoration is unlikely to become a funding priority unless socially and economically viable uses for the sediment are found.

Which is where I come in – I'm coordinating work by the Illinois Department of Natural Resources (IDNR) and other agencies to find uses for the sediment. Traditional placement options include island building, stockpiling and simply discarding. But we're also investigating beneficial use as topsoil.

Research

In greenhouse experiments, a variety of plants germinated and grew as well in sediment as native topsoil. The sediment's also performed well in field situations with University of Illinois pedologist Dr. Robert Darmody finding that, for the most part, the sediment's highly fertile and has the physical properties of central Illinois topsoil – which is among the best in the world.

This is not surprising, given that much of it eroded from farms and streams in the watershed. Unlike that generated by many harbour and navigation projects, Illinois River sediment contains little sand, comes from a freshwater environment, and for the most part is in areas that don't confine or concentrate industrial discharges.

The need for bulk topsoil in rural central Illinois, however, is somewhat limited, due to its relative abundance – and areas such as strip-mined land that do need soil are often 30km to 100km from the river, making economical transport difficult.

That said, many old industrial sites in need of topsoil for redevelopment are located near the waterway and close to areas that need dredging. Providing soil to these areas can greatly increase their value for commercial and residential development – and the Chicago Department of Environment also hopes to restore some of them to prairie and wetland habitat.

The Peoria Pie Dump – a day after being excavated from the lake, the sediment was dumped on the East Peoria ex-power plant site destined to become a park

Benefits

Using sediment for redevelopment sites has several economic and social advantages with tangible benefits at both the removal and placement sites – eg:

- Soil doesn't have to be taken from farmland or other sites, and
- Using barges to transport the sediment drastically cuts the number of trucks needed to haul soil from and through otherwise sleepy rural areas.

A small-scale demonstration of this concept occurred when the Fon Du Lac Park District in East Peoria dredged its Spindler Marina access channel for recreational craft on Peoria Lake. The sediment was placed on deck barges by a Cable Arm environmental bucket, moved 8km, unloaded into trucks and driven 5km to a barren field once occupied by a power plant that had left compacted yellow clay as the surface cover. That field was slated for redevelopment as parkland.

The sediment dried, forming large clods, and in the summer was broken and graded to hasten the formation of a granular soil structure. By October the site was covered with vegetation and during the past three
Beneficial Use Of Dredged Material

Rain puddles sediment on the future park site

Chicago Park District's chief landscape architect Barbara Wood inspects drying sediment at the East Peoria park site a month after it was placed.

In early July an agricultural disk was used to break up and level the dried sediment.

Looking more like a park! By October the field was covered with a variety of plants, even though it wasn't seeded.

Gubernatorial Backing

Lt. Governor Pat Quinn is a strong advocate of innovative projects designed to provide ecological and economic benefits.

River restoration has bipartisan support dating back through four gubernatorial administrations and Lt. Governor Quinn chairs the Illinois River Coordinating Council, a working group of state and local agencies now developing projects to reduce future sediment inputs to the river system and remove existing deposits... projects likely to last decades.

"Using river sediment as a solution for topsoil needs is an innovative and exciting opportunity. Seldom does one project address environmental problems in two regions of the State and at the same time provide recreational and economic enhancement. This concept could be the model for other redevelopment projects near waterways," said Lt. Governor Quinn.

An initial project is the redevelopment of the 231-hectare US Steel South Works Mill. A 6.7-hectare lakefront parcel covered with steel mill slag is the first suggested development area, where sediment will be used to form a park. And Lt. Gov. Quinn announced in January that funding for moving sediment to the site has been approved, with work expected to begin in the Spring.

Further Studies

Experience with the Spindler project led the team to investigate high solids options for handling sediment and to minimize the amount of water transported over long distances. Funding provided through the US Army Corps of Engineers (USACE) Rock Island District supported two demonstrations. 1) Clamshell-dredged sediment was trucked to a field, left overnight, then loaded into the hopper of a concrete truck via a displacement pump and successfully pumped through a 32m placing boom (it was also placed using a truck-mounted, 32m conveyor belt). The sediment was

A soil core from the new park clearly shows the interface between the yellow clay that covered the old power plant site and the dark soil formed by sediment - grass roots penetrated the entire sediment layer during the first season.

Steel mill slag and thin patches of soil with weeds cover the site where officials plan to use sediment as topsoil.

years of observation, the sediment's developed good soil structure and been colonized by typical soil insects and fungi.

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easily handled by the belts, transfer point and belt cleaners and both devices placed sediment in the field to a depth of about 120km.

2). About 900 tons of sediment were clamshell into a hopper barge - care was taken to collect as little free water as possible. The barge was then towed 262km to Chicago, unloaded into dump trucks with an excavator bucket and hauled about 2km to an old landfill undergoing remediation. The sediment was cohesive and its moisture content was about 30% of sample weight - it formed piles about 80cm high when dumped from the trucks.

Last Spring, five plots of commercial grass mixes were planted in the sediment and progress was followed through the summer. In September, all five plots were doing well and soil formation had also progressed well with granular structure extending beyond 25cm and a variety of soil insects already in situ. Weeds and other plants readily colonized areas where grass was not planted.

FINALLY...

Studies of the sediment's agronomic value have proceeded more quickly than chemical contaminant evaluation, mainly due to the cost of sampling the many backwaters. Chemicals in areas under study are generally somewhat above background soil levels, but lower than regulatory levels established for human health for sewage biosolids application and industrial cleanup.

To help resolve the issue, the Chicago Department of Planning and Development funded a risk assessment of the sediment near Spindler Marina that concluded it was suitable for use as topsoil at our parkland redevelopment site. Future evaluations will focus on its suitability for other uses...

The next step is a large-scale pilot project to determine the feasibility of long distance transport of sediment for use as topsoil - sediment will be placed at a number of depths and configurations to help determine efficient methods for future work. Resource managers and developers are hopeful that the sediment-derived topsoil will prove to be both safe and manageable for several applications.

"The eroded topsoil in our rivers is a resource out of place," says Congressman Ray LaHood, who represents many communities along the Illinois River. "Using it to restore the health of the land is a good solution to two problems."

More info at www.wmrc.uiuc.edu (under Illinois River)

About The Author

John Martin's a senior scientist at the Waste Management and Research Centre of the Illinois Department of Natural Resources, working with industry to improve competitiveness by finding ways to reduce the waste they generate. He's a former chairman of the Illinois Pollution Control Board, which promulgates the State's environmental regulations and adjudicates enforcement cases.

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