Identification of degraded stream sections is used to support restoration of the Illinois River.

Long Doung of the ISWS conducts a stream channel assessment near an exposed pipeline in Hallock Creek.

Watershed Assessment

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The "glory" days of the Illinois River are full of accounts of the rich diversity of fish and wildlife it once supported. Many current efforts to enhance and even restore some of that diversity have been successful (e.g. restoration at Emiquon Marsh). Despite these efforts, the Illinois River Basin continues to lose much of its treasured ecosystem value. What is the state doing to address this problem and how are current ILRB assessments different from what was done before?

Exploring the background regarding the problems the ILRB faces may help tackle these questions. The state of Illinois, facilitated by the Department of Natural Resources, is working with the United States Army Corps of Engineers, other state and federal agencies, nongovernmental organizations and local stakeholders to restore the ILRB. These organizations have identified sediment from Illinois River tributary watersheds as a major culprit behind the decline in the Illinois River ecosystem. Excessive sedimentation harms the ILRB ecosystem by infilling the Illinois River mainstem, backwater lakes and side channels. Where does all this sediment come from?

Erosion is a natural process and the resulting sediment comes from all landscapes. However, too much erosion and resulting sediment delivery have caused problems in the ILRB. One of the top contributors of sediment is stream channel erosion. Significant stream channel erosion occurs when the energy of running water in a stream exceeds its common natural variations, causing the stream to de-stabilize. Channel instability can result from natural and human factors. Many natural factors include geology of the landscape, soil type, and

Erosion of the channel bed (channel incision) causes streambanks to fail and undermines the vegetation in Senachwine Creek. Excessive algae in the stream also may indicate water quality problems.

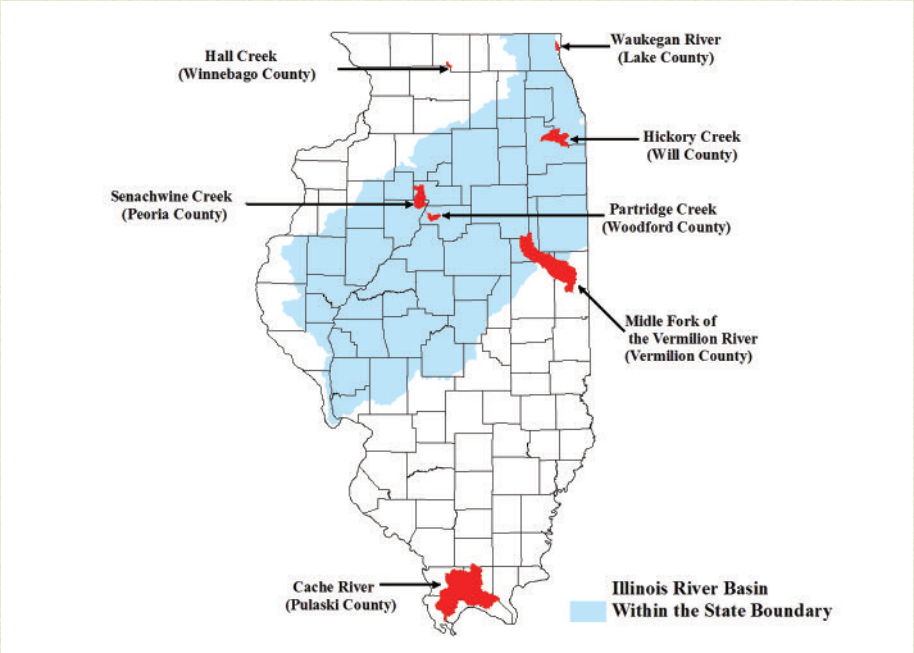
natural changes in precipitation, storm frequency and vegetation cover. Human factors include changes in urban and rural land use and drainage modifications. These factors affect the amount of potential energy (force) that running water has available to dislodge soil from stream channel beds and banks and carry it downstream.

Excessive erosion and subsequent sediment deposition often lead to a host of problems for nature and man. Biologically productive streambeds (i.e natural stream riffles) can be impacted by downstream channel incision, mass wasting of river bluffs and other erosion processes. These changes can result in either scouring or burial of the channel bed. This leaves less effective habitat for aquatic species, causing declines in highly favored game fish species such as bass and walleye. Also, existing infrastructure, such as bridges and pipelines may become exposed by channel downcutting and damaged by floating debris, thereby increasing chances of failure or incurring huge repair costs.

Riparian habitats also become more fragmented as stream channels erode laterally and cut into farmland, homesteads and park areas. In areas of particularly severe stream channel erosion, stream restoration work is a commonly prescribed solution. To best help stakeholders implement stream restoration, the DNR, USACE and State Scientific Surveys are assessing ILRB watersheds to pinpoint areas most in need of restoration.

There are two main ways in which this round of assessments is different from those that were done before. First, systematic, watershed-wide assessments that collect critical, new information about watersheds are being adopted as part of the "standard protocol" for data collection and analysis. Regarding the stream drainage component, past assessment efforts only collected and analyzed stream habitat and biological data. The recently developed assessment protocol is pioneering because new stream channel stability information (channel geomorphology) is being collected and integrated into the analysis. Second, the new protocols consider how localized problems may be symptoms of more system-wide processes. This will extend the effectiveness of management strategies implemented by federal, state and local resource managers.

Cooperation among several agencies and across different levels of the government forms the backbone of this assessment effort. At the state level, the DNR Office of Resource Conservation has been funding the watershed assessments. At the federal level, the USACE utilizes the assessment data as match to implement restoration projects. The state/local cost-share for restoration is 35 percent and the federal share is 65 percent. This method of cost-sharing eases the State's overall financial burden for watershed assessments and resulting restoration projects. In terms of interagency cooperation, the Illinois State Water Survey subcontracts the Illinois State Geological Survey and the Illinois Natural His-



Map showing locations of select assessment areas and stream restoration and naturalization demonstration projects across Illinois.

Erosion scours at the toe of a stream bank in Senachwine Creek until the upper bank collapses leaving tons of loose bank material ready to be transported by the next flood.

tory Survey for more detailed geologic and biologic data.

The initial stage of the new watershed assessments involves prioritizing which watersheds in the ILRB should be assessed. To achieve this, the Illinois State Water Survey coordinates with a DNR-USACE systems analysis team to select watersheds based on their physical conditions, ecological conditions and restoration potential using the following criteria:

- Watersheds with the highest sediment loads or most potential to reduce sediment delivery to the Illinois River
- Watersheds experiencing changes in population growth or urbanization rates that threaten ecological quality
- Watersheds with greatest potential for improvement, protection and expansion of habitat for regionally significant species
- Watersheds with the potential to be self-sustaining
- Watersheds with existing local, state and federal support

Once priority watersheds for assessment have been identified, then aerial reconnaissance flights are flown over major streams in the selected watershed. The flights are conducted using a helicopter with a stabilized aerial video camera linked to a Geographic Positioning System. They provide the capability to better describe, map and present locations of land features represented in the aerial imagery.

Through aerial reconnaissance, individual tributaries experiencing particularly severe stream channel erosion are identified for more detailed field investigations. In the field, both channel stability and biological habitat data are collected. The channel stability data include channel geometry, bank angles, channel bed and bank material, type and extent of erosion, sediment deposition, and bank and riparian vegetation. The morphology of each stream segment assessed is classed in a 'Channel Evolution Model.' The CEM is simply a tool used with other channel characteristic data to help predict future conditions with or without restoration work. The observations at many sites along a stream gives a 'bird's eye' view of the entire stream, enabling restoration work to address larger, underlying problems in the watershed and not just local issues.

Field investigation data are analyzed along with other geologic, hydrologic and biological data for each priority watershed. The ISGS integrates the field channel stability analyses with historical aerial photos to help track stream channel planform changes in the entire watershed over the past 60 years. The aerial imagery, existing Geographic Information System data and new hydrologic, biologic and geomorphologic field data are all collected and managed using a computerized invento-

Channel incision occurs when the stream adjusts to modifications made throughout the watershed putting at risk infrastructure like this exposed pipeline in the main channel of Senachwine Creek.

Mass-wasting of the valley walls delivers large amounts of sediment directly to the channel.

ry and database management system. Analysis of stream habitat and biological data are supported by the channel stability analysis to provide stream behavior on a broader scale, helping focus restoration dollars on more critical stream segments.

Through the data analysis process, the ISWS identifies those stream sections in each watershed requiring the most immediate attention and makes recommendations for remediation efforts. In some cases, the ISWS even demonstrates how these recommendations can be implemented. Recommended treatments include continued implementation of traditional upland farm treatment, such as terracing, water and sediment control basins, grassed waterways, and no-till practices. Emerging practices include in-stream and near-channel naturalization (such as constructing riffles and pools) to reduce channel slope and create a better balance between stream erosion and deposition processes, floodplain wetland restoration, more holistic management of forested slopes and riparian areas, and stabilization of mass-wasting sites.

In the final stage of the watershed assessment process, these potential recommended projects are matched to appropriate agencies for further evaluation or implementation. Actual restoration of recommended project areas is dependent upon voluntary landowner cooperation. Success of this process can be increased by adding further implementation incentives such as cost-share funding. Additional information from these new watershed assessments are intended to supplement and compliment existing watershed management efforts.

Senachwine Creek was one of the first watersheds that the ISWS assessed using this new systematic approach. The Senachwine Creek watershed drains approximately 58,000 acres in western Marshall and northeastern Peoria Counties and discharges directly into Upper Peoria Lake of the Illinois River near the town of Chillicothe. Changes in stream channel form occurred as the stream adjusted to changes in both natural (climate change) and human induced factors (landcover change and drainage modifications) which significantly impacted landscape conditions within the watershed.

The assessment concluded that 15 stream channel segments and near-channel sites within the Senachwine Creek watershed were potential targets for stream restoration. These segments were identified based upon both poor channel stability rankings and habitat scores, as well as indication of historical stream planform instability. Therefore, these segments may continue to provide significant sediment loads to the channel. The available data also suggests that these 15 areas were eroding because of systemic watershed-wide causes (particularly agricultural land-use conversion) and not independent, localized factors.

With the most unstable and biologically degraded stream channel and near channel areas identified, federal, state, and local agencies can select, design, and implement specific stream restoration projects and integrate these projects into a more meaningful watershed-wide management strategy.

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(Photo by the Department of Zoology and Center for Ecology, Southern Illinois University.)

Constructed pool and riffles act as a grade control in the Cache River while enhancing habitat by increasing the pool size, supplying cover and water aeration.