Juday creek restoration

Community Groups Work With Notre Dame Researchers to Restore a Creek Running Through New Golf Course

Summary

In the mid-1990s, the University of Notre Dame in South Bend, Indiana, was set to begin development on the Warren Golf Course. The University initially designed the course to have Juday Creek, a historic waterway with declining ecological health, run through it. To protect the creek, community groups worked with Notre Dame researchers to restore it in conjunction with the development of the golf course. After the restoration, researchers found native species returned to the creek and the aquatic environment improved. The creek is now used as an educational site and is a prominent natural feature on a championship golf course.

Member of the field crew monitoring fish populations in a restored section of the creek. Photo courtesy of Patrick Shirey

How Did They Do It?

Action	Applicable Resources

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Developed a watershed management plan • The Juday Creek Task Force developed a plan that focused on improving the creek's ecological health and addressing future development. • The Task Force worked with the community to create a separate master plan protecting the watershed and passed ordinances on watershed management <https://library.municode.com/search?stateId=14&clientId=3333&searchText=stream&contentTypeId=CODES> .	• The USEPA has a Handbook for Developing Watershed Plans to Waters <https://www.epa.gov/nps/handbook-developing-wate protect-our-waters> . • The Lake County, Illinois, Stormwater Management Commissio watershed management plans <https://www.lakecountyil.gov/ Management-Plans> .
Created a restoration design and commenced construction • Notre Dame researchers and golf course designers worked with an engineering company to determine the design features to help restore the ecosystem health of the creek. • The engineering firm constructed new sections of the creek that incorporated natural buffers.	• The US Department of Agriculture Natural Resources Conserva restoration handbooks <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/ that cover restoration, design, protocol, and more. • View ERIT's adaptation strategies for lakes, rivers, and streams and-streams.html> to learn how to prepare for the climate impa ecosystems.
Monitored the creek and conducted outreach • After the restoration was complete, researchers conducted habitat surveys yearly for five years and then continued monitoring fish populations thereafter. • Researchers host university and K-12 classes at the creek to conduct further monitoring and to teach about aquatic ecosystems.	• This research paper <https://www.ecologyandsociety.org/vol2 outlines the monitoring plan used after the restoration. • This news article <https://research.nd.edu/news/finding-the-s Dame Research discusses how the restoration project revitalize educational opportunities. • This policy article <https://doi.org/10.1002/esp.4828> discuss Indiana Drainage Law (a copy of the paper can be obtained by e author).

Background

Indiana has seen a dramatic decline in its wetlands, which in turn affects other aquatic ecosystems and water quality for people. Thirty-seven percent of the watershed where Juday Creek is located was wetlands in 1829, but by 2000, wetlands accounted for less than one percent of the area. With the loss of wetlands, nutrients and sediments were unable to be filtered out, which harmed the aquatic ecosystem and the people that used the water for drinking and irrigation. Wetland losses also increased the flood risk to property and infrastructure in the area.

The loss in wetlands was in part due to Indiana's drainage law that was enacted in 1889 and has been regularly updated. The drainage law, in general, focuses more on agriculture than protecting aquatic ecosystems. Under the law, Juday Creek was reclassified as a drainage ditch instead of its historic designation as a creek. This distinction resulted in management activities, such as dredging, wood removal, and the mowing of buffer zones that disconnected the creek from its historical channel and allowed excess nutrients and sediment to enter the waterway. Additionally, traditional erosion control measures like riprap were deflecting the problem and pushing the nutrients and sediment further downstream.

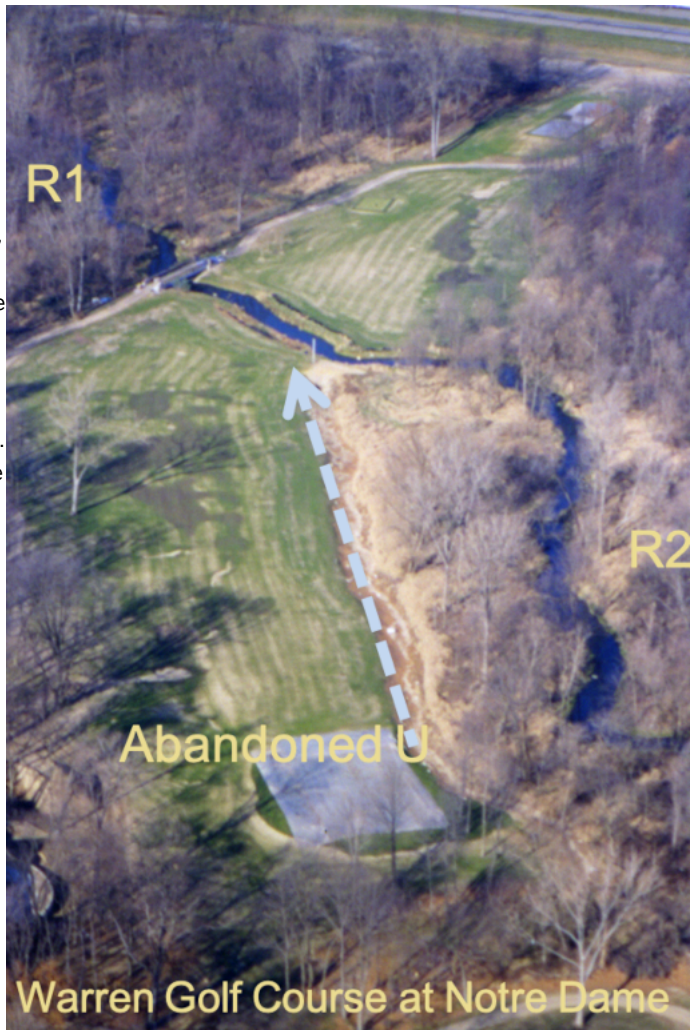
After continued management activities and development along the creek, researchers found an abrupt loss of species: the number of fish species declined from six to one. Researchers also noted an 85 to 90 percent reduction in the insect-based food sources in the stream. When the researchers presented the evidence to County officials, the officials started to scale back some of the activities. However, by that point, development in the area made it difficult for those changes to make much of an impact on the ecosystem's health.

To address the water quality issues in the creek, residents formed the Juday Creek Task Force. The Task Force developed goals and plans to protect the overall watershed. Specific actions included preserving and improving the creek's populations of brown trout and other species, reducing erosion, establishing buffer strips, reducing mowing of stream side vegetation, and creating a planning process that would address future development, among others. However, once the University announced plans to develop the golf course, and the plans did not consider the aquatic ecosystem in the design, the task force reached out to Notre Dame researchers to determine what they could do to protect the aquatic ecosystem.

Implementation

Using previously collected data, the research team looked at how best to purify the creek water and provide a pathway that would reduce the runoff and pollution. Due to the high levels of fine sediment in the original creek's channel, the team decided to create new channels to reduce the level of sediment and nutrients.

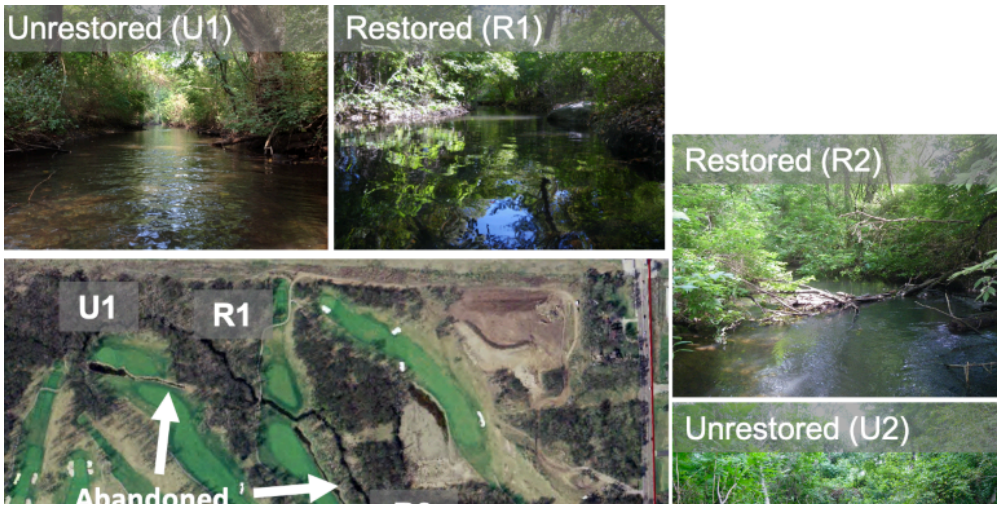
To come up with a new design focused on creating a self-maintaining stream channel, increasing habitat diversity, and enhancing fish diversity, the team brought in a local environmental engineering firm. Working with the firm, the researchers settled on putting in two reconstructed sections that would run through the golf course before eventually connecting back to the original creek. They also decided to require a 20-meter buffer zone on both sides of the creek to help reduce nutrient runoff and limit interaction with the golf course. Requiring a buffer zone in the creek restoration plan was essential since the drainage law lets those areas be mowed at will, which allows nutrients from the surrounding area to run off into waterways more easily. In total, the restoration design included the following changes:



An aerial view of the golf course showing the original channel and the restored channels. Photo courtesy of Patrick Shirey

- 20 percent increase in stream length
- Eventual 67 percent increase in tree canopy over the stream
- 600 percent increase in the number of pools in the stream
- 700 percent increase in logs in and around the stream
- 60-times increase in boulders
- 35-times increase in gravel substrate
- 20-meter vegetation buffers on each side
- Measuring fish communities within two 60-meter sections in the restored branches and two 60-meter sections in the unrestored areas for comparison

Researchers created a five-year plan to monitor the impacts of the restoration using the 60-meter sections. Once the engineering firm completed construction, the researchers began their monitoring plan. They conducted habitat surveys, measured water temperature, and conducted fish surveys.



Funding

Construction cost $200,000 and the initial 5-year monitoring cost around $100,000. Funding came from U.S. Geological Survey grants and in-kind donations. Monitoring costs beyond five years were also partially covered by volunteer hours.

Timeline

Construction took place in the fall of 1997. The five-year monitoring plan ran from 1997 – 2002. Additional monitoring has occurred since 2002, with the fish community being monitored through 2013 and classes and research projects still working in Juday Creek as of spring 2021.

Equity and Justice

The researchers recognize the Pokégnek Bodéwadmik, and the displaced Bodwéwadmik and myaamiaki, whose ancestors were the previous caretakers of Juday Creek. While members of the indigenous communities did not directly work on this project, their knowledge of the plant communities was and is important in the management of the lands on which Juday Creek is located. The Pokégnek Bodéwadmik community is actively working on stream and wetland restoration in Michigan and Indiana. The researchers also note that Indiana's drainage laws and institutions have resulted in past and current injustices to the indigenous communities, and when conducting restoration work, they should be part of the conversation.

Outcomes and Conclusions

The creek's two new reaches run through the golf course before merging into the creek. The reaches are surrounded by forested area that helps prevent contamination and erosion while also providing a natural feature for the golf course. The new design also recycles water through a series of pumps and the buffer zones help limit the stream's interaction with the regular maintenance of the golf course.

Juday Creek is healthier than it was previously. Through years of monitoring, the researchers noticed a change in the fish populations present. Although one of the initial goals was to protect the non-native brown trout swimming in the creek, the trout population decreased over time. However, native fish species such as largemouth bass, smallmouth bass, and rock bass are once again found in the creek and are increasing in abundance. Other native species like the johnny darter and mottled sculpin also returned. Many of these native species are intolerant to silt and pollution in the water, so their return is an indicator of increasing stream health. While upstream sections in the watershed have still seen negative ecological impacts from development, the restored section of the creek provides healthy habitat for many aquatic organisms.

To continue monitoring the health of the creek while also educating on watershed protection, researchers bring their classes and K-12 schools out to the creek for research. One of the issues with educating the public is the lack of access to streams and waterways that can result in people not knowing about aquatic ecosystems or the issues affecting them. By having a public access site at Juday Creek, the researchers can help educate the community on aquatic ecosystems and what goes into protecting them.

Challenges

Indiana's drainage law was the initial challenge in this project. This law classifies Juday Creek as a ditch, which subjects it to less protection and allows for management practices, such as mowing and wood removal, that are detrimental to the health of the aquatic ecosystem. Additionally, watershed management upstream of the creek causes effects that the researchers cannot tease out. For instance, road runoff, land use changes from development, poor agricultural practices, other golf courses, and well withdrawal upstream can increase the sediment and nutrient levels running downstream to the creek and decrease the amount of water flowing into Juday Creek.

Takeaway Message

Patrick Shirey, one of the researchers who studied Juday Creek, said, "Think about the long-term management of these ecosystems on a wide scale before addressing the actual restoration to make sure you have all the information you need to be successful. Also, we need to rethink our state drainage laws, which were enacted by states under pressure from the federal government to encourage wetland and stream habitat destruction for row-crop agriculture. Coupled with the Indian Removal Act, these drainage laws served as an act of systematic genocide toward indigenous residents who grew crops with sophisticated techniques of crop rotations involving more than 30 species. As a result of wetland destruction under drainage law, we suffer from soil loss, risk of flooding, reduced habitat for fish, and poorer water quality for people. When you are doing any type of restoration project, you should consider inviting the indigenous people who identify the area as their ancestral land to participate in the planning process. By incorporating indigenous communities into the planning process, we can work on combating the injustices that have occurred."

Similar Case Studies

- Bloomington, Indiana Naturalizes Creek Bank to Manage Stormwater and Establish Native Plants <bloomington-indiana-naturalizes-creek-bank-to-manage-stormwater-and-establish-native-plants.html>
- Corydon, Indiana Removes Two Dams to Restore Ecosystem Health and Water Quality <corydon-dam-removal.html>

For more information about the Juday Creek restoration, contact

- Patrick Shirey
  Visiting Research Assistant Professor
  Department of Geology and Environmental Science
  University of Pittsburgh
  --
  Certified Ecologist
  Certified Fisheries Professional
  Ecology Policy LLC
  patrickdshirey@gmail.com
- Gary Lamberti
  Professor
  University of Notre Dame
  glambert@nd.edu

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