United States Department of Agriculture

Forest Service

Eastern Region

2006

Restoring Aquatic Organism Passage at Road-Stream Crossings

2003-2005 Accomplishment Report

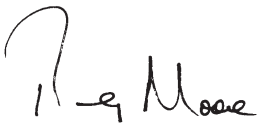
Eastern Region
USDA Forest Service

From the Regional Forester

The Eastern Region has been actively engaged in restoring aquatic organism passage at road-stream crossings during the past few years. I am pleased to share the highlights of several successful projects implemented during this time. Partners are critical in the success of this strategic effort.

Between the years 2003-2005, over 20 projects were implemented that opened access to nearly 40 miles of stream habitat, and improved approximately 21 acres of stream-riparian and wetland habitat. Ten percent (10%) road and trail (TRTR) allocations funded the majority of work with additional dollars coming from other program areas, including external partners. In addition to the projects providing passage and improving water quality, a strategic series of "Train the Trainer" Inventory and Assessment and Design for Stream Simulation workshops were held across the Region to standardize protocols for identification and remediation of passage barriers. Many partners were involved in these "hands on" sessions. Largely due to the integrated training and leveraging of partner funds, the Region successfully competed for nearly $2.5 million of Transportation bill "Safety, Accountable, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)" funds in Fiscal Year 2006.

State, local, tribal, federal entities, and non-government organizations have come together to accomplish these programs and projects. Many more are currently in the planning stages. Please take time to read about this exciting effort.



Randy Moore
USDA Forest Service
Eastern Region
626 E. Wisconsin Avenue
Milwaukee, WI 53202
414-297-3600

Contents

Integrated Training for Aquatic Organism Passage (AOP)

Places where roads cross aquatic systems - for instance, streams or wetlands - are often locations that prevent native aquatic organisms from moving upstream. Fish, crayfish, mussels, salamanders, and other aquatic and semi-aquatic species often find impassable barriers at road crossings. Many hundreds of such culvert or low-water ford barriers exist across the Eastern Region.

The Region has been actively conducting inventories and assessing road crossings thought to block organism passage. After the inventory and assessment locates problem sites, crossings are designed and installed that remove the barriers. Phase I "Train the Trainer" workshops on the inventory and assessment process for determining aquatic organism passage began in 2003 and were completed in 2005. Phase II "Train the Trainer" sessions on low stream simulation design were completed in 2006.

In Fiscal Year 2006, the Region successfully competed for nearly 2.5 million of Transportation bill "Safety, Accountable, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) funds, largely due to the integrated training and leveraging of partner funds.

Partners were critical in the success of this strategic effort. Non-governmental organizations such as the State Chapters of American Fisheries Society, The Nature Conservancy, National, State Councils and local Chapters of Trout Unlimited, along with federal agencies such as the U.S. Environmental Protection Agency, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, and the Federal Highway Administration, are teaming up with state agencies including their departments of natural resources, environmental quality, and transportation. At some workshops, tribal representatives and county employees participated in order to embrace this new knowledge.

Figure 1: Map of the Eastern Region (R9) Forests

Forests across the Region have inventoried hundreds of crossings and installed new or revised bridges, culverts, or low-water fords at scores of locations (Figure 1). These projects improve the survival of rare species, allow expanded fishing opportunities into additional waters, improve water quality, and provide a safer road system for the traveling public. In addition to these improvements, all projects are evaluated to ensure that aquatic invasive species are not allowed to access previously inaccessible waters. The training workshops were coordinated and taught by the San Dimas Technology and Development Center Training Cadre, Eastern Region Aquatic Organism Passage Training Cadre, as well as several Washington Office Fish Ecology Unit and Stream Systems Technology Center staff members.

The Eastern Region now has basic culvert inventory information related to aquatic organism passage (fish, mussels, salamanders, turtles, crayfish etc.) and terrestrial biota. Utilizing the findings and making projections, it is estimated that 2,500-3,000 structures will need to be replaced over time. Cost estimates, to replace crossings that impede aquatic organism passage, improve water quality, improve driving safety, and restore riparian and wetland habitat, range from $125 million to $300 million (using $50,000 to $100,000/site).

Table 1: FY 2003-2006 Aquatic Organism Passage Integrated Training (Train the Trainer) workshops held in R9.

Year	Host National Forest	Training Phase	Number of Students/ Partners
2003	Green Mountain	I[1]	32
2004	White Mountain	II[2]	37
2004	Hiawatha	I	25
2005	Chequamegon-Nicolet	II	40
2005	Mark Twain	I	32
2006	Mark Twain	II	18

[1] Phase I = Inventory and Assessment
[2] Phase II = Design for Stream Simulation

Figure 2a: Classroom Studies

Figure 2b: Field Exercises

Integrated training provided students practical experience with hands-on case studies (*Figure 2a*) and field exercises (*Figure 2b*) for both Phase I and Phase II training.

Program Accomplishment

Between 2003 and 2005, forests in the Eastern Region completed culvert and bridge replacements that reduced driving hazards and improved water quality by reducing sediment. Over 39 miles of aquatic habitat for more than 60 species were made accessible and approximately 20 acres of stream-riparian and wetland habitats were improved (Table 1) using TRTR funds alone or in combination with other funding sources.

Table 2: FY 2003-2005 Aquatic Organism Passage Construction Projects accomplished in the Eastern Region.

Year	Forest	Project Name	Habitat Affected	Focus Species
2003	Allegheny	Fish Passage Surveys	NA	Blandings turtle
2003	Chequamegon-Nicolet	Elvoy Creek Culvert	6.0 miles	BKT, BNT
2003	Chequamegon-Nicolet	UNT Sailor Creek Culvert	1.25 miles	5 minnow species
2003	Chippewa	FS Road 2199 Culvert	0.5 miles 1.0 acres	5 minnow & darters
2003	Green Mountain	Bingo Brook Culvert	0.5 miles	BKT
2003	Shawnee	Kincaid Lake Crossing	4.0 miles	51 species
2003	Shawnee	Rattlesnake Ferry Crossing	1.5 miles	51 species
2004	Chippewa	Woodtick Trail FR2107	19 acres	NA
2004	Green Mountain	Brandon Brook Culvert	1.4 miles	BKT
2004	Huron-Manistee	Indian Bridge Replacement	6.0 miles	GRH
2004	Hiawatha	Sturgeon River Bridge Replacement	0.25 miles 0.25 acres	STH, BNT
2004	Ottawa	Porterfield Creek Culvert	1.5 miles	BKT, RBT
2004	Superior	Inga Creek Culvert	2.1 miles	BKT
2004	Chequamegon-Nicolet	Hines Creek Culvert	3.0 miles	BKT
2005	Chequamegon-Nicolet	Wolf River Culvert	2.5 miles	SMB
2005	Green Mountain	Hale Brook Culvert	1.5 miles	BKT
2005	Huron-Manistee	48 ½ Mile Road Culverts	3.0 miles 1.0 acre	BKT, BNT
2005	Hiawatha	Indian River Culvert	2.5 miles	NP,WHS
2005	Ottawa	Cranberry River Culvert	1.0 miles	BKT, RBT
		TOTALS	39 miles 21 acres	>60 species

Table 2 Key

BKT = brook trout
GHR = greater redhorse
STH = steelhead
SMB = smallmouth bass
RBT = rainbow trout
BNT = brown trout
WHS = white sucker
NP = northern pike

Integration and Leveraging Resources

Fish diversity in the United States has been declining due to pollution, invasive species, habitat degradation, and habitat fragmentation. Decline creates negative impacts on stream ecosystems. Recent studies indicate that culverts at road crossings can fragment habitat, acting as barriers to the upstream movement of fishes, preventing essential spawning migrations, and inhibiting recolonization of streams after natural or man-made disturbances. With over 50,000 road crossings on eastern National Forest lands, these crossings represent a serious threat to the viability of native fish fauna. Our forests are using models developed for predicting which culverts are likely to be impassable by fish based on measured culvert characteristics and literature reviews of fish swimming and leaping ability. The three models evaluate movement of trout, minnows, sculpins, and darters in streams with culverts classified as passable or impassable. The results of this study provided fisheries biologists with tools for evaluating, prioritizing, and implementing road crossing management projects in addition to increasing our knowledge of fish movement in small streams.

Besides fish passage studies, forests evaluated potential projects for multiple objectives that included, but were not limited to, reducing risk to other aquatic species, human health, emergency repairs to roads, and restoring access. In addition, projects were to address one or more of the Chief's Four Threats (fire and fuels, unwanted terrestrial and aquatic invasive species, unmanaged recreation, and loss of open space). Projects were to consider partnership potential and leveraging of funds, as well as enhancement, restoration, or protection of ecological function in watersheds. Finally, projects were to contribute to conservation and recovery of species at risk. The Inventory and Assessment process (Phase I) provided the information to address integration and leveraging of resources both internally and externally.

Allegheny National Forest: Forest Fish Passage Surveys-2003

Project Purpose/Objectives: The purpose of the project was to begin the documentation of stream crossings by roads and their ability to pass fish moving upstream.

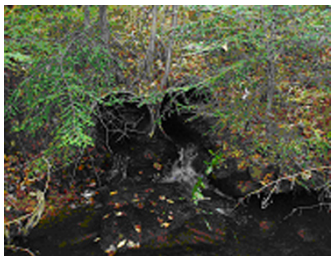


Figure 3a: Pair of pipes elevated above the stream channel posing a passage barrier

Figure 3b: Arched culvert at grade on Forest Road 155-passable

Work Performed: Fifty-two crossings were surveyed following the San Dimas Phase I protocol. In addition, fish surveys were conducted on 48 crossings to determine the presence and types of fish upstream and downstream of each crossing. In 2003, we focused our efforts on data collection. In early 2004, the Forest began using the FISHXing software to assess the ability of fish to pass through culverts (Figures 3 a and b). In 2003, six employees from the Forest attended the training put on by San Dimas and the Eastern Region Training Aquatic Organism Passage Cadre to learn the procedures for conducting the assessment surveys.

Monitoring

Monitoring the effects of culverts has major implications.

Some techniques can detect passage, but may be limited when movement is infrequent or when it occurs over large spatial scales. Monitoring methods are needed to determine the influence of environmental factors on passage probability and to evaluate actual reproductive isolation caused by passage limitation. It should also document the re-establishment of population connectivity.

A combination of genetic, direct passage using antenna arrays and PIT tags, and population monitoring is currently being researched and evaluated by the Northern Research Station to provide managers with information on successful culvert remediation efforts.

Before

After

Before and After Photos of Selected Projects From 2003-2005

Chequamegon-Nicolet National Forest Elvoy Creek Culvert at FR 173 Rock Dam Road- 2003

Expected Benefits: 2003 was the first of three years planned to complete this project for the entire Forest. At the end of the project, we will have a thorough understanding of where the Forest needs to address sites to provide fish passage.

Project Purpose/Objectives: The FR 173 crossing of Elvoy Creek had four small culverts that were under-sized, too short and set too high, resulting in recurrent washouts, high culvert velocity, difficult fish passage and impacts to the stream channel. The objectives were to reduce failures and maintenance costs, reduce sedimentation, improve fish passage, and restore about 500 feet of stream channel.

Before

After

Work Performed: Temporarily divert the stream, remove 4 – 30" diameter culverts (total end area = 19.6 sq ft), install a 20'4"x4'6" aluminum box culvert (total end area = 73.1 sq ft) with headwalls and wing walls set 1 ft. below the upstream bed, armor with riprap, establish ditches and outlets to north of crossing, create low point to north, gravel and crown road surface, install silt fence, erosion control blanket and seed.

Benefits: Reduced failures and road surface erosion resulting in less sedimentation (estimated at 7.4 tons/yr) and much lower maintenance costs; improved fish passage in a Class I trout stream, particularly for young fish; and restoration of about 500 feet of stream from a wide, shallow to a narrower, deeper channel. The crossing is located just above the mouth of Elvoy Creek where it empties into Brule Creek and the upper Brule River. Elvoy Creek is one of the highest quality trout streams on the Forest.

Shawnee National Forest Kincaid Lake and Rattlesnake Creek Crossings-2003

Project Purpose/Objectives: To protect the streams from further erosion and sedimentation buildup and to provide administrative access to two areas. The first addresses an area near Kincaid Lake, and the second focuses on Rattlesnake Ferry (2nd crossing). In addition, protection of aquatic biodiversity was important. At the Kincaid Lake stream low water crossing, runoff from the roadway entered the stream that flows into the lake. At the Rattlesnake Ferry tributary low water crossing, runoff from the roadway entered the tributary to the Big Muddy River. Thirty-five fish species, five crayfish species, and eleven freshwater mollusks species are known to occur in the Big Muddy River near the Rattlesnake Ferry Low-water crossing. Biodiversity is extremely high.

Work Performed: Construction of two low water crossings, one at Kincaid Lake and one at Rattlesnake Ferry.

Benefits: Sediment reduction; riparian, fish and habitat improvements; water quality improvement and municipal water supply improvement.

Kincaid Lake Low Water Crossing – T7SR4WS34

Before

After

Rattlesnake Ferry Low Water Crossing II - T10SR3WS27

Before

After

Superior National Forest, Inga Creek Culvert Replacement-2004

Work Performed: Existing 4' diameter culvert had a 1.5' drop with an outlet velocity of 10.5 feet per second, which exceeded the swimming capacity of the fish. Pipe was removed and replaced with an 18' wide aluminum box culvert to equal bankfull width.

Benefits: Improved fish passage and decreased risk of flooding.

Before

After

Huron-Manistee National Forest, 48 ½ mile Road Culvert-2005

Work Performed: Replaced undersized culverts and paved approaches to the bridge past the crest of the hill on both sides using water routing techniques, guttering, and wing- ditches, to reduce sediment delivery.

Benefits: As a result of this project, an estimated reduction of 20 tons/year of sediment occurred. One acre of riparian habitat was improved with a total of three miles of stream habitat restored.

Before

After

Ottawa National Forest, FR630 – Cranberry River Culvert-2005

Project Purpose/Objectives: The primary objective of this project was to replace an undersized existing culvert that was preventing proper fish passage, eroding the road, and contributing sediment to the stream course.

Work Performed: Replaced the existing culvert, rehabilitated roadway approaches, placed crushed aggregate surfacing, stabilized slopes, and installed guide posts.

Benefits: Enhanced passage of aquatic organisms, decreased stream sedimentation from road surface erosion, and increased safety to the traveling public.

Before

After