IMPROVING STREAM HABITAT

FOREST STEWARDSHIP MANAGEMENT NOTE #31

INTRODUCTION

The presence of a stream on a property usually has a very positive influence on its recreational value, especially if it provides fishing opportunities. Unfortunately, the quality of fish habitat in many streams has been degraded by direct abuse and by poor practices on adjacent lands. Although, correcting some stream problems will require coordinated efforts throughout the watershed, there is much individual landowners can do to improve fish habitat in specific locations.

The Michigan Stewardship Incentive Program (SIP) recognizes the value of fisheries habitat enhancement efforts by providing cost-sharing for several types of practices, including: fencing to exclude livestock and stiles for access, establishment of grass or woody cover to stabilize banks, in-stream placement of woody debris, and construction of erosion control structures.

This Note gives general guidelines and summarizes recommendations on structures that are designed to improve fish habitat by modifying the stream channel and/or the stream bank. Sources of further information are listed.

GENERAL GUIDELINES

1. VERIFY NEED - If the need for improvement is not obvious, do not disturb existing conditions.

2. STREAM SIZE - Cross-channel structures (see below) should generally be restricted to small streams (annual flood volume not exceeding 200 cu. ft. per sec.). Bank structures (see below) may be installed in small or large streams.

3. STREAM GRADIENT - Structures installed on streams with gradients exceeding 3% require utmost care. Gabion structures (rock filled wire baskets) are more suitable for steeper gradients and larger flows, whereas log structures are better suited in slow-moving sections and smaller streams.

4. SPACING OF STRUCTURES - Structures should not be installed at too frequent intervals. As a rule-of-thumb, a stream should have a 1:1 ratio of pools to riffles.

5. LOCATION OF STRUCTURES - Locations selected for structures should have natural features that favor construction. For example, firm banks are needed to anchor structures.

6. OBSERVE STREAMFLOW EXTREMES - Proposed improvement sites should be observed during both low- and high-water periods before construction takes place.

7. CONSTRUCTION MATERIALS - To make log structures durable, use logs 14-16 inches or more in diameter whenever available. On shallow streams less than 12 feet wide, 10- to 12-inch logs may be suitable. Use naturally rot-resistant species when possible, especially above the water level.

8. MAINTAIN WOODY DEBRIS - Some landowners may be tempted to remove woody debris from streams for aesthetic or other reasons, but this should generally not be done. Woody debris, especially large material, provides cover for fish, improves stream channel characteristics, and promotes the growth of organisms that fish feed on (FSMN #28).

RECOMMENDATIONS ON SPECIFIC STRUCTURES

Many types of stream improvement structures have been designed for a variety of purposes. Some of the most commonly used structures are reviewed below (#7,8). Consult the References for details and additional methods.

IMPORTANT LEGAL NOTE: To legally construct some of the stream improvement structures described below, a permit may be required under Michigan's Inland Lakes and Streams Act. Contact your local Department of Natural Resources office or the DNR Permit Coordinator, P.O. Box 30028, Lansing, MI 48909 (517/335-4235).

1. CHANNEL BLOCKS:

PURPOSE - Consolidate flow into a single deeper channel to create additional fish-holding habitat, maintain cooler water temperatures, restore migration routes, and flush sediments.

DESIGN - Channel blocks often bear the brunt of flood waters so they must be stable. On small streams, single logs may be used. On channels 15-25 feet wide, triple log or crib structures are usually needed.

PLACEMENT - Upstream and downstream ends of side channels in braided streams and cutoffs in meandered streams.

2. BOULDER PLACEMENT:

PURPOSE - Provide overhead cover and resting areas for fish, and to increase stream depth.

DESIGN - Place clusters of large, irregular-surfaced boulders directly in the stream.

PLACEMENT - Advantageous in most situations, including riffles, runs, flats, glides, and open pools, and especially where current exceeds 2 feet per second.

3. BANK STRUCTURES:

PURPOSE - Provide overhead cover and resting areas for fish, provide habitat for aquatic insects and other fish food, and reduce erosion of unstable banks.

Cover Logs and Rootwads

DESIGN - Many configurations are possible. Any log over 10 inches in diameter is acceptable, but crooked logs over 16 inches in diameter provide the best turbulence and scouring. Logs can be pinned with 3/4-inch rebar to each other, to trees, or into the ground (54 inches or deeper). Logs can also be secured with cables. Portable jackhammers and underwater epoxy allow attachment where bedrock is shallow.

PLACEMENT - Open pools, runs or flats at least 6-8 inches deep, outsides of meanders.

Tree Cover

DESIGN - Fell whole tree into stream and anchor with cable and/or rebar pins. Anchor logs can be dug in or driven in with heavy equipment.

PLACEMENT - Any stream section where installation will not narrow channel enough to cause bank erosion, especially wide shallow areas with sand or gravel bottoms.

Bank Crib with Cover Log

DESIGN - Dig or drive logs into bank 4-6 feet in stable soils, 10 feet or more in unstable soils. Pin cover log just below normal water level.

PLACEMENT - Any area with unstable banks.

Log and Bank Shelter

DESIGN - Dig or drive support logs into bank. Span support logs with logs, boards, brush, rocks, or a combination of materials.

PLACEMENT - Open pools in low-gradient bends or meanders.

4. CHANNEL CONSTRICTORS (Deflectors):

PURPOSE - Constrict water flow so pools are formed by scouring and relocation of fine sediment and gravel. Single-wing deflectors form meander pools. Double-wing deflectors form midchannel pools.

DESIGN - Low-flow stream width should be narrowed 70-80%. Extend deflector log(s) 4-6 feet in to the bank, pin them down with rebar, and brace them from downstream with logs set into the bank. Fill wing angle with large rocks or logs, add sod or soil and seed, and stabilize with welded wire, if needed. Cover logs or other bank structures are often needed in conjunction with single-wing deflectors to prevent erosion of the opposite bank.

PLACEMENT - Nearly anywhere, but most advantageous in wide shallow riffles or flats.

5. CROSS-CHANNEL STRUCTURES (Dams):

PURPOSE - Create pools of deeper water by scouring action. Quiet water above the structure and along the edges of the pool below trap organic material used as food by stream invertebrates.

Cross Log and Revetment

DESIGN - Dig cross log into the stream bottom at an angle of 30-45^{o} to the streamflow. Angle revetment log(s) at 5-10^{o} to the flow. Set cross log and revetment log(s) well into the banks and pin it all together with rebar.

PLACEMENT - Most advantageous in low-gradient stretches, especially at the beginning of wide shallow bends with little cover.

Wedge Dam

DESIGN - Butt the two main logs at a 90^{o} angle so the wedge points upstream. Dig them into the streambed making sure the point of the wedge is 6-12 inches lower than the top of the logs at the bank and that the spillway height will be 6-12 inches. Set them firmly into the bank at the downstream end and attach them to the crib logs with rebar. Fill the cribs with large rocks or logs. Attach wire mesh, fiberglass cloth, boards, or some combination of these to the main logs and extend an apron upstream to prevent undercutting of the dam; cover the apron with flat rocks and gravel.

PLACEMENT - Generally limited to steep-gradient streams less than 30 feet wide with well-defined banks.

K Dam

DESIGN - Span the stream with one log, setting it well into the banks and bracing it from downstream with logs on either side at about 45^{o}. Cut a spillway into the main log to concentrate low flow in the center of the stream. As for wedge dams, create an apron upstream of the dam to prevent undercutting and fill the crib with rock or logs.

PLACEMENT - Generally limited to steep-gradient streams less than 15 feet wide with well-defined banks.

6. MISCELLANEOUS METHODS - In addition to the channel improvement structures described above, landowners should be aware of a few other stream habitat improvement and protection methods.

BEAVER PONDS - The overall impact of beaver ponds on fisheries is complex, variable, and controversial. Nevertheless, water levels in beaver ponds can be a valuable stream improvement technique in some situations. Beaver control permits may be obtained from the Michigan Department of Natural Resources District Offices. Reference #2 discusses methods of beaver control.

RIPARIAN ZONE PRACTICES - The health of a stream is strongly influenced by the condition of the vegetation along its banks (#2,3,6,7). Riparian vegetation stabilizes the soil, produces food for stream organisms (via plants and animals that fall in), and provides shade that tends to keep water temperatures suitable for fish (#6). Voluntary guidelines have been established for conducting many forest management practices near streams in ways that will help to maintain water quality (#4).

REFERENCES

FSMN #'s refer to other Forest Stewardship Management Notes in this series.

#1 Baker, C.O. and F.E. Votapka. 1990. Fish passage through culverts. U.S. Dept. Transportation, Fed. Highway Admin., Rept. No. FHWA-FL-90-006.
#2 Hunt, R.L. 1988. Management of riparian zones and stream channels to benefit fisheries. Pages 54-58 in USDA Forest Service GTR NC-122.

#3 Hunter, C.J. 1990. Better trout habitat. A guide to stream restoration and management. Island Press.
#4 Michigan Department of Natural Resources, Forest Management Division. 1993. Water quality practices on forest land (A manual for Michigan's forest land owners, managers and users). This publication is commonly referred to as the "Best Management Practices (BMP's)".
#5 Michigan Department of Natural Resources, Wildlife Division. 1986. Nuisance beaver control.
#6 Palone, R. 1991. The benefits of buffer areas for moderating stream water temperature. Forest Management Update, Issue 12. USDA Forest Service NE-State and Private Forestry.
#7 Payne, N.F. and F. Copes. 1988. Wildlife and fisheries habitat improvement handbook. USDA Forest Service, Wildlife and Fisheries Admin. Rept. (unnumbered).
#8 Seehorn, M.E. 1992. Stream habitat improvement. USDA Forest Service R8-TP 16.

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