2024 Sport Fish Restoration Project Award Nomination – Sport Fishery Development and Management OR Research and Surveys

Project Title: Implementation and Evaluation of Strategic Wood Addition in Vermont Brook Trout Streams

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Need:

Most rivers in eastern North America historically contained large volumes of large woody material that served as fish habitat and influenced geomorphology. Large wood volumes are much lower in today's rivers because of historic beaver harvest, clearing of rivers to aid navigation, timber harvest, agriculture, and development. Kratzer and Warren (2013) found that the lack of in-stream wood is one of the main factors limiting Brook Trout *Salvelinus fontinalis* biomass in northeastern Vermont. As a result of that study, Vermont Fish and Wildlife Department (VFWD) and Trout Unlimited began strategically adding large woody material to northeastern Vermont Brook Trout streams in 2012. Since that time, we have monitored the function and longevity of strategically added large woody material.

Objectives:

- Strategically add large woody material to coldwater streams to improve Brook Trout habitat and stream function.
- Quantify the effects of strategic wood addition on Brook Trout populations and fine sediment storage.
- Assess the function and longevity of strategically added large woody material.

Procedures:

Strategic wood addition involves the use of chainsaws to fell streamside trees into streams. The process is strategic because it involves scouting and planning to ensure that treated streams have the proper characteristics that would make them likely to retain added wood and that the added wood will benefit fish habitat and stream function. The selection of trees to add and the methods used to secure them are also strategic. In small streams, some trees are cut to length and placed by hand for maximum effect. In larger streams, a grip hoist is used to position felled trees in optimal configurations.

Electrofishing is used to assess the effects of added wood on Brook Trout populations. We have sampled nine pairs of control and treatment sites two years before treatment and during ten years after treatment.

Function and longevity of added wood has been assessed by nearly annual visitation of over 1,000 individually identifiable wood addition sites. During each site visit, the number of large wood pieces is recorded along with a qualitative assessment of the functions being performed by the added wood. These functions are pool formation, capture of coarse organic material, retention of sediment, providing cover for fish, streambed degradation (scour that increases depth), narrowing of low flow channel, and facilitating access of the stream to its floodplain. In 2023, we also estimated the volume of fine sediment being stored at 76 randomly selected wood addition sites.

Results:

From 2012 to 2024, Sportfish Restoration grants have partially funded the completion of strategic wood addition on 55 miles of Brook Trout streams in northeastern Vermont. Kratzer (2018) demonstrated that Brook Trout biomass tripled on average within three years after strategic wood

addition. Ten years after strategic wood addition (2023), much of the large woody material had degraded, but Brook Trout biomass was still twice as high as it was before wood addition.

The majority of added wood has remained functional where it was placed. On large streams (bankfull width approximately 25 to 40 feet), 87% of strategic wood structures were performing at least one habitat or fluvial function in 2023. The most common functions performed were retaining organic material (80%), providing cover for fish (75%), and retaining sediment (56%). The half-life of these large-stream structures is estimated to be approximately 30 years. On smaller streams (bankfull width less than approximately 25 feet), 99% of structures were performing at least one function where they were originally placed. Retaining organic material, providing cover, and retaining sediment were the most common functions, but these structures were also likely to form pools (54%). Failure rate on small streams has been so low that we have not be able to estimate a half-life. It is important to note that wood that moved from its original location is still performing a function in the stream, just not where it was originally placed.

Strategic wood addition structures are storing large volumes of fine sediment (diameter less than one cm). The average volumes of fine sediment stored by strategic wood structures on large streams and small streams are 3.1 m^3 and 4.4 m^3, respectively. The grand total of fine sediment stored in all stream reaches treated with strategic wood addition from 2012 to 2022 was approximately 11,415 m^3, which is equivalent to 1,493 loads carried by a standard dump truck (10-yd^3 capacity). This is an underestimate of the total volume of fine sediment stored because we did not measure sediment stored in the flood plain. This fine sediment contains phosphorus, which can now be stored and processed in the headwaters rather than being transported downstream to areas that already have too much fine sediment and phosphorus.

Evaluation/Benefits:

After 12 years of strategic wood addition in northeastern Vermont, we have proven that strategically added wood performs fish habitat and fluvial functions for over a decade, and we predict that it will continue to function for many decades to come. Based on the increase in Brook Trout abundance that we have observed as a result of strategic wood addition and the number of stream miles treated with this method, we conservatively estimate that there are now approximately 76,000 more Brook Trout swimming in northeastern Vermont streams.

The techniques that have been proven in northeastern Vermont, are now being used in other parts of the state and in other parts of the eastern United States. In part because of professional connections fostered by the American Fisheries Society, the research completed in the northeastern Vermont “laboratory” is informing woody habitat management in New Hampshire, Maine, West Virginia, Prince Edward Island, and likely other jurisdictions. Vermont staff have been invited and have travelled to Maine, New York, and Prince Edward Island to present and instruct on strategic wood addition. Sportfish Restoration also funded the development of the Vermont Strategic Wood Addition Handbook (Kratzer 2020).

Literature Cited:

Kratzer, J. F., and D. R. Warren. 2013. Factors limiting Brook Trout biomass in northeastern Vermont streams. North American Journal of Fisheries Management 33:130-139.

Kratzer, J. F. 2018. Response of Brook Trout biomass to strategic wood additions in the East Branch Nulhegan River watershed, Vermont. North American Journal of Fisheries Management 38:1415-1422.

Kratzer, J. F. 2020. Vermont Strategic Wood Addition Handbook. Vermont Fish and Wildlife Department, Montpelier.