Success and Benefits of Stream Restoration

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With the advent of EPA's "watershed approach" to water quality management in the early 1990's, and the increasing mitigation requirements associated with Corps of Engineers Section 404 permits, the interest in stream corridor protection and restoration has grown by leaps and bounds. Water quality at a given point in a stream is not only affected by measurable point and non-point sources but also by factors in the upstream watershed including near and far field land-use practices, in-stream geomorphology, and riparian zone structure. This "watershed approach" has resulted in a revival of interest in and funding for stream corridor protection and restoration.

Restoration is defined by the National Research Council as the "the re-establishment of pre-disturbance aquatic functions and related physical, chemical, and biological characteristics" (NRC, 1992). The ultimate goal of stream restoration is to improve water quality, in-stream habitat, and riparian habitat such that the biotic integrity of the stream is improved, approaching the original undisturbed condition. Practically speaking the aquatic biota (fish, macroinvertebrates, and algal communities) of a restored system should show improvement over the previous unrestored condition.

Common anthropogenic causes of stream impairment include channelization, agriculture, urban sprawl and associated run-off, and silviculture. Some in-stream impairments resulting from these causes, which lend themselves to repair through restoration, are excessive erosion and sedimentation, excessive nutrient loading, and bacterial contamination.

Stream restoration approaches vary dependant on the degree of impairment and the objective of the restoration, and can include several different levels of action; from exclusive natural attenuation, to active intervention, which often includes physical alteration of the stream corridor. Active restoration techniques often used as part of the restoration process include, removal of stressors (point discharges, cattle access, etc.), bank stabilization, removal of dams, re-establishment of channel sinuosity, riparian zone restoration/enhancement, and placement of riffles.

A cursory review of EPA's River Corridor and Restoration website (www.epa.gov/owow/wetlands/restore) will reveal the growing number of restoration projects that have been or are being completed today. The science behind the techniques

used for restoration continues to grow rapidly as more projects are completed. However, the next logical step in the restoration process is the determination of restoration success. Are completed restoration projects returning an expected level of improvement in biological integrity? Research recently completed indicates that restoration projects do have the potential to meet the improvement objectives. The following research review provides the results of one such study.

An Assessment of a Small Urban Stream Restoration Project in Northern California. (Alison H. Purcell, Carla Friedrich, Vincent H. Resh, 2002)

In this research paper, Purcell et.al., evaluated the success of a stream restoration project by assessing stream habitat improvement, macroinvertebrate community improvement, and local resident response. Habitat and macroinvertebrate community attributes were assessed at several stream reaches, which included restored reaches, unrestored reaches, and a reference condition in a nearby stream. Habitat quality and macroinvertebrate community characteristics were evaluated using EPA's rapid bioassessment techniques. Resident attitudes were evaluated through use of a survey distributed to residents within one block of the restoration project.

Habitat was assessed using 10 qualitative parameters (scores of 1-20 each) designed to characterize the quality of in-stream cover, substrate, flow, and riparian habitat. Habitat quality was found to be dramatically improved in the restored reach compared to the unrestored reach, with total qualitative assessment scores of 119 versus 79, respectively. However, the restored reach habitat quality was still found to fall short of the reference condition, which scored a total of a 144.

Six macroinvertebrate community metrics were calculated for each reach evaluated. Metrics included taxa richness, family richness, total abundance, family biotic index, EPT richness, and percent EPT. Five of the six macroinvertebrate metrics analyzed for the restored reach demonstrated improvements over the unrestored reach, although still not attaining the level demonstrated in the reference reach.

Results of the resident surveys were mostly positive, with 84% indicating they enjoyed living near the project, and 82% believing that the project goals met their expectations.

Link to full research paper:
http://classes.csumb.edu/ESSP/ESSP461-01/world/Seminar_2/streamresto.pdf

Evidence further supporting the success of stream restoration projects in improving the biological integrity of a stream was recently presented at the annual meeting of the North

American Benthological Society. A presentation by K.J. Gerard and R.A. Hellenthal entitled: Response of Aquatic Invertebrates to a Stream Restoration in Northern Indiana, stated that "macroinvertebrate populations showed significantly higher densities and diversities in restored versus control stream reaches…"

With the on-going improvement in restoration techniques and the addition of pre and post project monitoring, the future of stream restoration appears favorable and it appears that the restoration objective of improving in-stream biological integrity and aquatic function to a previously undisturbed system is achievable.

References

Gerard, K.J., Hellenthal, R.A., 2003. Response of Aquatic Invertebrates to a Stream Restoration in Northern Indiana. Bulletin of the North American Benthological Society. 20(1):364

Purcell, A.H., Friedrich, C., Resh, V.H., 2002. An Assessment of a Small Urban Stream Restoration Project in Northern California. Restoration Ecology. 10(4):685-694.

Restoration of Aquatic Ecosystems. National Academy Press. Washington, D.C. 1992

Additional Stream Restoration Links

Stream Corridor Restoration: www.usda.gov/stream_restoration

Site provides access to the interagency guidance document entitled Stream Corridor Restoration. Currently the most comprehensive and most used resource on stream restoration.

USDA Sediment Lab: www.sedlab.olemiss.edu/index.html

Site presents a diversity of stream channel research, including erosion control, flow hydraulics, and sedimentation modeling. Several stream restoration projects are discussed.

Erosion Control: www.forester.net/ec.html

Link to the on-line version of the journal Erosion Control. Good practical resource on the state of the art in erosion control and bank stabilization.

USDA Stream Systems Technology Center: www.stream.fs.fed.us/

Good site for general stream assessment and restoration information.