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Overview of Vol.2, No.1 - Rivers and Streams

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Stream ecology is a relatively new science, branching off from the study of general ecology early in this century and growing steadily ever since. We have added steadily to our knowledge base regarding hydrology, channel form, anadromous fish, riparian zone habitat and in stream processes. With this enhanced knowledge of the river continuum comes not only the realization of our own environmental mistakes, but also the inheritance of the ecological sins of past generations. As Kate Howe's paper points out, many river systems are currently degraded and need serious rehabilitation. Logging, damming, mining, channel manipulation, development and agricultural practices have inflicted serious damage to many rivers and streams, resulting in increased phosphorous, nitrogen and sediment loads, decreased oxygen levels, increased temperature, and excessive bank erosion.

Fortunately, the consequence of this degradation has been a call to arms on the part of citizens, environmental groups and fish and wildlife organizations, all of whom are pressing for the elimination of negative impacting practices and restoration of river ecosystems. Early this year, the President announced the American Heritage Rivers Initiative, calling for the protection and restoration of rivers throughout the country. Often, aquatic restoration efforts are catalyzed by a flagship fish species, such as Chesapeake Bay's striped bass or Montana's endangered bull trout. Trout and salmon angling groups and government agencies across North America have invested an incredible amount of time and money in an effort to restore the original structure and function of once great trout and salmon rivers. The west coast is home to thousands of miles of salmon spawning habitat, and consequently, millions of dollars have been spent in attempts to restore these habitats.

In some situations, where major stressors like logging have been eliminated or modified, small scale restorations can have a significant impact on fish and invertebrate populations. By halting watershed level stressors that effect temperature, runoff and infiltration, water quality can sometimes be returned to acceptable levels, making local efforts more feasible. In their essays, Terry Zapzalka and Kate Howe discuss how local restoration efforts can improve fish species diversity and richness in historically degraded stream channels. Clearcutting in riparian areas removes all sources of large woody debris that would normally fall into streams, creating channel complexity, pools, benthic invertebrate habitat and fish cover. The Forest Service, State natural resource departments and the U.S. Fish and Wildlife Service are using large woody debris placement as a primary method in stream restorations. On the same scale, riffle and pool creation is being used to restore the spawning areas of salmonid species in degraded streams.

The degree to which these small scale restoration efforts are successful depends on many factors. Woody debris and riffle structures are very successful on low or medium gradient streams with a mild or non-existent flood regime, but can become detrimental in high gradient streams with periods of high discharge. During flooding events, structures can become damaged and lose function, or structures can fail completely and become barriers to fish passage (Frissell and Nawa 1992). Extensive data collection and detailed site specific hydrological data is needed for small scale projects to be engineered successfully. In many cases, restoring stream channel morphology with site-scale remedies is like waxing a car in hopes of getting the vehicle to run. There are usually more formidable forces at work.

On a larger spatial and temporal scale, Michele Hanson addresses the methods involved in riparian forest revegetation. Some of the most degraded rivers are those that border agricultural areas and consequently lack a method by which nutrient and sediment flow are abated. Developmental pressure also threatens stream habitats by increasing the percentage of impervious surface coverage. A typical housing or commercial development creates impervious surface coverage of 60-70% in watersheds, while data has shown that impervious coverage of over 10% is usually lethal to trout species (Minnesota DNR 1996). Overland flow combined with a lack of infiltration carries pollutants and sediment directly into stream channels. Hanson's paper deals with a sub-watershed level approach to stream restoration; an essential strategy in any aquatic system restoration or reclamation. No amount of woody debris can restore oxygen levels or decrease nutrient concentrations in-stream. It is plain to see that a clean stream with no structural complexity is as bad as a polluted stream with a high degree of complexity. The watershed must be treated as a single multi-faceted entity, and not as the sum of its parts.

Perhaps the most frustrating aspect of stream restoration is that little discussion is ever devoted to halting the source of the degradation. There is little thought to protecting watersheds by elimination of the stressor, usually because of economic or cultural reasons. Despite our expanding knowledge base, the idea of watershed level restoration is nothing new: the USDA Forest Service handbook on stream improvement discusses lessons learned in the 1930s:

> *"Stream improvement was looked upon by some as a cure-all for the environmental ills of a trout stream. Experience showed that only a relatively few types of simply designed structures were necessary and that stream improvement fell far short of making desirable stream habitat if destructive forces were at work in the watershed."*

References:

Frissell, C.A., and R.K. Nawa. 1992. Incidence and causes of physical failure of artificial habitat structures in streams of western Oregon and Washington. *N. Am. J. Fish. Mgmt.* 12:182-197.

Minnesota Department of Natural Resources. 1993. *Report on the status of DNR Metro Region Trout Resources*. Minnesota DNR Special Publication, St. Paul, MN.