Report for 2001CA4001B: Examining the relative influence of riparian and upland landcover and landuse on instream habitat: Improved methods for the Russian River basin.

- Conference Proceedings:
  - Opperman, J. and A. Merenlender. in press. Factors influencing the success of riparian restoration in the Russian River basin: deer, sheep, and hydrology. Proceedings of the California Riparian Habitat and Floodplains Conference, Sacramento, California, March 2001

Report Follows:

Examining the Relative Influence of Riparian and Upland Land Cover and Land Use on Instream Habitats: Improved Methods for the Russian River Basin

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Project Summary

Numerous studies have established that large woody debris (LWD) plays a critical role forming and maintaining habitat for anadromous fish. However, nearly all of these studies have been conducted in the conifer-dominated forests of the Pacific Northwest (PNW). In California, anadromous fish also utilize watersheds dominated by hardwoods. Although managers are currently trying to restore habitat for anadromous fish in these watersheds, very little is known about the role of LWD in shaping this habitat. In this study, we are examining the relationships between riparian vegetation, instream LWD, and fish habitat in hardwood watersheds. We are studying riparian and landscape-scale influences on aquatic habitat in the Russian River basin and other hardwood-dominated watersheds in Northern California. Progress has been made in three primary areas: Riparian vegetation, large woody debris, and in-stream habitat.

We conducted field work examining the above described interactions in 25 hardwood-dominated streams in Northern California. Although the loading of woody debris (volume of LWD per unit area of channel) in hardwood streams was considerably lower than values reported from streams in conifer-dominated forests in the PNW, we found many of the same relationships between instream wood and fish habitat. For example, debris-formed pools had significantly greater cover (i.e. shelter) values than any other pool type. In hardwood streams with relatively high LWD loading, the majority of pools were formed by woody debris and, across streams, the occurrence of pools was positively correlated to LWD loading. Because hardwood debris is considerably smaller than that derived from mature conifers, single pieces of hardwood debris rarely formed a pool. Instead, pool formation was generally influenced by complex debris jams that spanned or partially spanned the channel. These jams were often stabilized by the presence of living trees within the debris jam. Many riparian hardwoods have resilient growth forms such that they can be pushed over into the stream, become part of a debris jam, and then continue living and growing as long as their root system maintains contact with the bank. This "living LWD" results in more stable debris jams because key pieces of the debris jam are stabilized by their living root masses and do not decay.

Improved methods for characterizing hardwood riparian corridors through remote sensing

The structure and extent of the riparian forest strongly influences the amount and size of LWD that enters a channel. Because of the important relationship between riparian vegetation, LWD, and fish habitat, land managers seek methods to monitor and characterize the quality of riparian

vegetation within a basin or across a region. We are developing techniques to characterize riparian corridors in hardwood-dominated regions using high-resolution remotely sensed imagery. We are collaborating with a scientist at California State University, Sonoma, to analyze riparian corridors in the Sonoma Valley using ADAR - high-resolution (4 m), multi-spectral imagery. The techniques that will allow us to: 1) identify riparian corridors on the landscape; 2) quantify their width and extent (i.e. presence of gaps); and 3) characterize their species composition and structure (e.g. size, maturity).

Landscape-scale influences on aquatic habitat

We also studied how land use and land cover (LULC) across the landscape influences habitat within streams. In particular, we are examining the relationship between LULC at various scales and the embeddedness (the amount of fine sediments) of spawning gravels utilized by anadromous fish. We are utilizing 10 m Digital Elevation Models (DEMs) to designate unique watersheds above each of 380 reaches in the Russian River basin that have been surveyed for fish habitat, including embeddedness values, by the California Department of Fish and Game. Within these watersheds we are investigating the relationship between gravel embeddedness and LULC at several scales: 1) a 30 m buffer surrounding the reach; 2) the same buffer but also extended varying distances above the reach; and 3) the entire watershed above the reach. Initial results indicate that the LULC of the entire watershed explains the most variability in the embeddedness values; the level of embeddedness is positively correlated with the amount of agriculture and development in the watershed, while it is negatively correlated with the amount of forest and chaparral in the watershed. We are currently using the same data sources to develop a Hydrological Proximity Model (HPM) that creates an index to describe the way that LULC interacts with runoff patterns over the entire watershed. We will then examine whether the outcomes of HPM provide additional explanatory power.

Publications

Opperman, J. and A. Merenlender. *in press*. Factors influencing the success of riparian restoration in the Russian River basin: deer, sheep, and hydrology. *Proceedings of the California Riparian Habitat and Floodplains Conference*, Sacramento, California, March 2001.

Professional Presentations

Opperman, J. and A. Merenlender. Restoration of riparian corridors and large woody debris in California's hardwood-dominated watersheds. Joint Annual Meeting of the Ecological Society of America and the Society for Ecological Restoration, Tucson, Arizona, August, 2002.

Opperman, J. and A. Merenlender. Evaluating riparian restoration projects to guide anadromous fish habitat restoration in California's hardwood-dominated watersheds, American Fisheries Society Annual Meeting (California-Nevada Chapter), Lake Tahoe, April 2002.

Opperman, J., C. Brooks, A. Merenlender, and Z. Young. Large woody debris and fish habitat in hardwood-dominated streams of the Russian River Basin, Poster presented at the Salmonid Restoration Federation Annual Conference, Ukiah, California, March 2002.

Opperman, J. and A. Merenlender. Large woody debris and habitat for endangered fish in California's Mediterranean-climate watersheds, San Francisco Bay Area Conservation Biology Symposium, San Francisco State University, California, January 2002.

Opperman, J. Riparian restoration in the Russian River basin, California Riparian Habitat and Floodplains Conference, Sacramento, California, March 2001.

Student Training

Michael Gerstein, Undergraduate, Environmental Science, UC Berkeley
Sanaz Mamarsedegghi, Undergraduate, Conservation and Resource Studies, UC Berkeley
Susan Mahler, graduate, ESPM, UC Berkeley
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Collaborative Efforts

We are collaborating on imagery analysis with Professor Ross Meentemeyer, Department of Geography, Sonoma State University, California.

A channel-spanning debris jam creating a pool with high shelter values. The piece of wood in the foreground (in the shape of a Y rotated counter-clockwise) is a living red willow (Salix laevigata) which has fallen into the stream but is still rooted and living. This living key piece traps much of the other wood in the debris jam.