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GEOL 351 Seminar
LWD Bibliography

Abbe, T. B. and D. R. Montgomery (1996). "Large woody debris jams, channel hydraulics and habitat formation in large rivers." Regulated Rivers Research and Management **12**: 201-221.

This paper focuses on a large river and large pieces of wood. In effect, log jams are the focal point, with emphasis placed on the particular types of log jams that occur in nature, as well as the hydrologic effects that they have on rivers.

Log jams can form stable structures controlling local channel hydraulics and providing refugia for riparian forest development. Particular jam types (i.e., bar top jams, bar apex jams, meander jams) are associated with distinctive patterns of LWD, pools, bars and forested islands. Abbe and Montgomery point out that 70% of all pools are associated with log jams, and the pools that are formed by these log jams can provide complex cover, refugia, and sediment trapping – all beneficial to various biotic communities.

Debris jams have two hydraulic effects due to obstruction of flow: vertical or downward acceleration of flow creates scouring, and horizontal flow accelerates due to a decrease in cross sectional area. Changes in channel hydraulics due to presence of stable LWD alter the channel topography and surface textures, thus leading to morphological changes in the channel. Geomorphological features such as islands, pools, and bars can affect the quality of aquatic and terrestrial riparian habitat. Abbe and Montgomery discuss the long term implication for debris/log jams, stating that LWD buried in floodplain sediments could continue to function as a hydraulic structure after being re-exposed and could provide long term refugia for floodplain riparian communities, forming old-growth riparian forest patches.

This paper was a bit long and filled with hard-to-remember acronyms, but I think the informational substance was there. I thought the pictures, figures, and tables were clear and added to the paper. I could have survived without getting into some of the engineering details, but, again, the overall message regarding flow around LWD was interesting and made clear in the end.

Gurnell, A. M., H. Piegay, et al. (2002). "Large wood and fluvial processes." Freshwater Biology **47**: 601-619.

Gurnell et al. outline the relationship between large wood and the physical characteristics of river ecosystems. An important point that is highlighted in this paper is the relationship between the size of the wood and the size of the river channel. Gurnell et al. define 'small' channels as those whose width is less than the majority of the wood pieces. 'Medium' channels are those whose width is less than the majority of all the wood pieces. 'Large' channels are wider than the length of all the wood pieces delivered to them.

In small rivers, the actual size of the LWD is not as important, and the wood tends to stay near where it was inputted. Wood mobility is relatively low and wood pieces provide important structures in the river, controlling rather than responding to the hydrologic and sediment transfer characteristics of the river.

As the ratio of wood piece length to channel width decreases, more significant interaction between LWD and fluvial processes occur. In medium rivers, the length of many pieces of wood are close to the width of the channel, making wood length and form critical to its stability within the channel.. Both the orientation of the wood in relation to the channel and the nature of wood accumulations change with increasing channel width.

Gurnell et al. point out that in studies of wood dynamics in large rivers, most illustrate that once the channel width is greater than the length of the wood, factors such as flow, sediment transport, wood buoyancy, and form complexity dominate the storage and dynamics of the wood. In larger rivers, wood deposition often leads to bars and islands that promote forest establishment.

This paper is a very thorough review of large wood and geomorphologic processes. Most importantly, attention is drawn to how many factors related to wood supply and transport are related to river size. Wood supply is important because it influences how wood interacts. The dynamics and storage of wood are also important and highly dependent on fluvial processes. This was very informative from a strictly structural/morphological point of view, but I was surprised to see it printed in Freshwater Biology, as there were little biological implications.

Johnson, L. B., D. H. Breneman, et al. (2003). "Macroinvertebrate community structure and function associated with large wood in low gradient streams." River Research and Applications **19**: 199-218.

Johnson et al. studied two streams in the upper Midwest in order to determine the relationship between wood habitats and wood abundance and the compositional and functional attributes of the macroinvertebrate communities in these streams. Although low volumes of wood were found in the subject agricultural regions of Michigan and Minnesota, Johnson et al. found that wood habitats were important contributors to macroinvertebrate species richness and diversity in these streams.

Regional diversity was found to be extremely high, and Johnson et al. attributed this partially to wood, but more due to varying and unique habitat types across the region. More specifically, there was more pool habitat with low flow and soft sediments in the Michigan sites, compared to Minnesota. This habitat structure increases the importance of wood structures as hard substrates for macroinvertebrate colonization. In contrast, sites in the Minnesota region were characterized by more riffle habitat, and thus, more hard substrates available for colonization.

Johnson et al. found that a mean of 55% and 26% of taxa in Michigan and Minnesota, respectively, were added to a stream when wood was present. This is a huge contribution to local diversity. Although previous studies have demonstrated the relative importance of wood substrates in rivers relative to the availability of other stable substrates, the patterns observed in Michigan and Minnesota were not consistent with this. Total taxa richness did increase with increasing number of habitats, however, taxa richness at the individual wood and non-wood communities did not. This suggests that wood may be colonized disproportionately to its abundance and the availability of other habitats, resulting in greater species richness at wood habitats. Other studies have found that species richness responses to increasing habitat complexity operates on a species-specific basis, and this may have been the case in Johnson et al.'s work. Johnson et al. point out that the structural complexity of wood compared to other habitats is much greater, thus providing increased habitat and surface area for colonization as well as increased food resources.

This paper presents not only an interesting study and results, but provides a great source of related literature, making very clear connections to some key papers that helped me in my literature search. The details of the physical structure provided by wood are touched on and important details noted. Johnson et al. found highest proportions of collector-gatherers at wood sites, probably due to the effects of wood in slowing flow rates and increasing organic matter standing downstream of the wood. However, the functional composition of macroinvertebrate communities surrounding wood may vary with its location in the channel relative to local flow regime.

Some important conclusions can be drawn from this work, primarily that much local diversity can be attributed to the presence (but not necessarily abundance) of wood habitats, and that habitat heterogeneity appears to be the major driving variable accounting for local biodiversity. Johnson et al. implicate that for management purposes, wood should be considered an important habitat structure, and attempts should be made to moderate stream clearing practices that are common in agricultural regions.

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