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Within-catchment variation in stream invertebrate growth patterns: influence of riparian cover and stream temperatures on invertebrate growth

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Stream temperature is determined by a dynamic interaction of processes operating over various spatial and temporal scales, both within and beyond catchment boundaries. This results in a physical complexity that poses distinctive challenges to the aquatic biota and affects their growth rates, productivity and life cycles. Despite being a key variable in driving lotic ecosystems, there are insufficient studies which adequately characterize the thermal regime in rivers and its effects on stream ecology. In this context, several investigations have stressed the importance of riparian tree cover and adjacent land management in influencing stream temperature. However, successful land management to mitigate, for example, against the effects of future changes in climate is dependent, firstly, on developing adequate process understanding.

This study attempts to understand how differences in the riparian tree-cover are reflected in subtle, local changes of stream temperature and subsequently in invertebrate growth. The 30 km2 Girnock Burn in the northeast of Scotland is representative of many Scottish upland catchments. The upper parts of the catchment are dominated by Calluna moorland with small forestry in the middle section creating low-width buffer strips, and a broadleaved alluvial forest of alder (Alnus glutinosa) and birch (Betula spp.) in the lower parts near the confluence with the River Dee. Stream temperature and invertebrate length were measured in comparable habitats along the longitudinal gradient of the river. The presence of an extensive broad-leaved tree canopy in the

alluvial forest section of the Girnock Burn strongly influences the net radiation which dominates stream energy inputs during the summer months resulting in a moderated thermal regime. Statistically significant differences in mean size and size distribution of two invertebrate families - Baetidae and Hydropsychidae - were found in the Girnock, between all sites separated by no more than 5 km. Highest variation between sites occurred during the time of emergence, implying local changes in timing and patterns of adult emergence which has also potential implications for their availability to predators. Evidently, riparian planting offer potential for mitigating higher temperatures and protecting stream habitat conditions, however the understanding the implications for in-stream ecology requires further research.