Stream Temperature in the Garcia River: The Relationships of Air Temperature, Canopy, and Geographic Position to Stream Thermodynamics

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Abstract

Stream thermodynamics result from complex temporal and spatial interactions of climatic and stream basin characteristics. Vegetative canopy is commonly identified as a dominant regulator of stream temperature at the stream reach level. Our recent work on coastal watersheds indicates that air temperature, watershed position, and sub-surface flows play a significant role in regulating summer stream temperatures, particularly at the basin scale. The importance of these factors is shown using two years of temperature monitoring data from six ambient air locations and 47 tributary stream and main river channel locations in the Garcia River Watershed. Temperature measurements were made every 30 minutes from late April to early November using Onset StowAway® temperature data loggers. Stream discharge, canopy, and reach distance measurements were made at the tributary stream and main river channel locations. Summer stream temperatures on the Garcia River and its tributaries are cooler in downstream positions compared to upper watershed positions. This phenomenon is the reverse of most basin level stream temperature models that predict increased stream temperatures with increased stream order within a basin. Vegetation canopy levels are equal or greater in upper watershed positions, and significant sub-surface stream flow returns occur at lower watershed positions. Due to coastal influence, an air temperature gradient exists from upper to lower watershed positions with significantly cooler air temperatures near the coast. Inland reaches and tributaries also exhibit a more pronounced rate of temperature increase over a given distance than do reaches and tributaries closer to the coast, despite higher or equal canopy levels on inland reaches. This suggests that the significance of canopy in regulating temperature on stream reaches in coastal watersheds will depend upon the watershed position of the reach. In our presentation we will present detailed

statistical analysis of stream temperature, air temperature, watershed position, canopy, and stream flow relationships at the reach and basin scale.

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