DO OPEN-CANOPY MOUNTAIN STREAMS COOL DOWN AFTER RETURNING TO FORESTED CONDITIONS?

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Summer maximum stream temperatures are a primary determinant of stream habitat suitability for cold-water species like trout. In the Southern Appalachian Mountains, trout are limited to small headwater streams due to temperature constraints. Sunlight and longwave radiation are the dominant drivers of spatial and temporal variability in stream temperatures. Consequently, the removal of riparian forest cover causes stream temperatures to rise until the outgoing longwave radiation (proportional to Tabs^4) matches the incoming shortwave. We have observed both rapid increases of daytime stream temperatures within riparian gaps and rapid declines of daytime stream temperatures after the stream returns to forested riparian conditions. Previous case studies have found very different rates of cooling below gaps. To quantify and better understand cooling downstream of gaps, we measured temperatures above, within, and below 12 riparian gaps near Franklin, North Carolina. Temperature responses to riparian cover changes varied widely. After returning to forested conditions, some streams cooled rapidly, some cooled slowly, and some continued to warm. The data suggest that smaller streams are more sensitive to riparian gaps and also cool more rapidly below riparian gaps. Understanding downstream cooling is critical for the development of riparian management policies for cold-water species.

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