Watershed development is a leading cause of stream impairment and increasingly threatens the availability, quality, and sustainability of freshwater resources. In a recent global meta-analysis, we found that measures of desirable ecological structure (e.g., algal, macroinvertebrate, and fish communities) and functions (e.g., metabolism, nutrient uptake, and denitrification) in streams with developed watersheds were only 23% and 34%, respectively, of those in minimally disturbed reference streams. As humans continue to alter watersheds in response to growing and migrating populations, characterizing ecological responses to watershed development and management practices is urgently needed to inform future development practices, decisions, and policy. In a study of streams in New England, we found that measures of macroinvertebrate and algal communities had threshold responses between 1–10% and 1–5% impervious cover, respectively. Macroinvertebrate communities had decreases in sensitive taxa and predators occurring from 1–3.5% and transitions in trophic and habitat guilds from 4–9% impervious cover. Sensitive algal taxa declined at 1%, followed by increases in tolerant taxa at 3%. Substantially altered algal communities persisted above 5% impervious cover and were dominated by motile taxa (sediment resistant) and those with high nutrient demands. Boosted regression tree analysis showed that sites with >65% and ideally >80% forest and wetland cover in near-stream buffers were associated with a 13–34% decrease in the effects of watershed impervious cover on algal communities. While this reduction is substantial, additional out-of-stream management efforts are needed to protect and restore stream ecosystems (e.g., created wetlands and stormwater ponds), but understanding their effectiveness is greatly limited by sparse ecological monitoring. Our meta-analysis found that restoration improved ecological structure and functions in streams by 48% and 14%, respectively, when compared to streams with developed watersheds and no management practices in place. However, ecosystem measures at restored sites were still only 53% of those in minimally disturbed reference streams. Some of our ongoing work further examines how watershed development and riparian condition affect stream ecosystem functions by altering the sources and delivery of nutrients and carbon. Our results can help inform management priorities and expectations, and they emphasize the importance of implementing mindful development and protective actions in a watershed context, especially in watersheds near impervious cover thresholds. Continued research on linked terrestrial-aquatic systems, improved BMP tracking, and ongoing monitoring will be essential to conserving and restoring the mechanisms that sustain valued ecological attributes and ecosystem services of streams.