



A global review on hydrological responses to forest change across multiple spatial scales: importance of scale, climate, forest type and hydrological regime

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Despite extensive studies on hydrological responses to forest cover change in small watersheds, the hydrological responses to forest change and associated mechanisms across multiple spatial scales have not been fully understood. This review thus examined about 312 watersheds worldwide to provide a generalized framework to evaluate hydrological responses to forest cover change and to identify the contribution of spatial scale, climate, forest type and hydrological regime in determining the intensity of forest change related hydrological responses in small (<1000 km²) and large watersheds (≥1000 km²). Key findings include: 1) the increase in annual runoff associated with forest cover loss is statistically significant at multiple spatial scales whereas the effect of forest cover gain is statistically inconsistent; 2) the sensitivity of annual runoff to forest cover change tends to attenuate as watershed size increases only in large watersheds; 3) annual runoff is more sensitive to forest cover change in water-limited watersheds than in energy-limited watersheds across all spatial scales; and 4) small mixed forest-dominated watersheds or large snow-dominated watersheds are more hydrologically resilient to forest cover change. These findings improve the understanding of hydrological response to forest cover change at different spatial scales and provide a scientific underpinning to future watershed management in the context of climate change and increasing anthropogenic disturbances.