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**Abstract**

Boreal regions contain more than half of the carbon in forested regions of the world and over 60% of the world's surface freshwater. Carbon storage and the flood control and water filtration provided by freshwaters and wetlands have recently been identified as the most important ecosystem services provided by boreal regions, with a value many times greater than current resource exploitation. Ecosystem services and sensitive ways of detecting their impairment have so far not been fully included in boreal conservation planning. Climate warming, via its effect on permafrost melting, insect damage, and forest fire, threatens to trigger large positive carbon feedbacks that may enhance the concentrations of greenhouse gases in the atmosphere, further amplifying climate warming. In a water-scarce world, there is increasing pressure to divert and exploit boreal freshwaters, and devising conservation plans to protect boreal freshwaters and their catchments is urgent. We propose a catchment-based approach that includes water and chemical mass-balances as a sensitive means of detecting early degradation of many ecosystem services in both catchments and freshwaters, and give some examples of where this has been advantageous in the past. The necessary modifications to current conservation planning are simple ones, and the advantages are great.

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The following maps were produced by GFWC for this paper.





