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Boreal ditched forest and peatland are more vulnerable to forest fire than unditched areas

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During summer of 2014 the largest wildfire in Swedish modern history occurred. The fire was ignited in a forest close to the Swedish town Sala and incinerated a total of 14 000 ha. The frequency of wildfires is expected to increase, due to effects of climate change such as increased temperature and decreased precipitation during the summer months. Wildfires can have a considerable impact on aquatic ecosystems and previous studies of wildfires have shown elevated concentrations of nutrients, cat- and anions. The area of the fire mainly consists of forestland, peatland and lakes and has been affected by acidification and intensive forestry. To assess the fire severity and the effects on the water chemistry, the fire severity were analyzed and classified using aerial phtographs and high resolution LIDAR data. The analysis indicated that increased fire intensity caused increased fire severity and that drained forested areas were more vulnerable to fire than undrained peatland. Measurements of water chemistry were conducted at nine streams and ten lakes inside the affected area. At two sites sensors for multiple parameters were deployed. During the initial three months of the post-fire period large peaks of ammonia-N and sulphate were observed in the streams and in a majority of the lakes while DOC was suppressed. In one stream Gärsjöbäcken the median concentrations of ammonia-N were 79 times higher after the fire. Due to nitrification the elevated concentrations of ammonia-N-nitrogen caused elevated concentrations of nitrate-nitrogen. The initial peak of sulphate caused a drop in ANC but after the peak had past ANC increased due to elevated concentrations of base cations. Correlation analysis of fire severity and water chemistry indicated that the maximum concentrations of ammonia-N increased with severely burned canopies in drained forested peatlands and in scorched open peatland.

In a future climate with increased dry spells extensive ditching operations in forested peatlands might be counterproductive as it promotes fire vulnerability even in cold boreal regions.