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Hydrological impacts of forest management in peatlands - a case of drainage network maintenance

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One fourth (5.5 Mha) of forests in Finland are growing on peatlands, which have been drained to improve forest growth. Forestry operations such as cuttings and ditch maintenance in these areas may increase leaching of suspended solids and nutrients, and deteriorate water quality in receiving lakes and rivers. To be able to control the environmental impacts of peatland forestry, we need to understand how forest management operations affect peatland hydrology. A process-based simulation model FEMMA was applied to quantify the effects of forest management operations on peatland water balance. The model includes separate computation routines for evapotranspiration in tree stand and understorey vegetation, snow accumulation and melt, water movement in unsaturated and saturated soil, and ditch drainage. Hydraulic characteristics of peat, as well as different drainage designs can be parameterised in the model. The model was applied to simulate hydrological effects of ditch maintenance, i.e. cleaning and deepening of the drainage ditches, in research catchments in Tilanjoki in northern Finland. The results were compared against snow, water table, and runoff measurements. The simulation results indicate that the effect of the ditch maintenance on water balance is dependent on stand characteristics. In tree stands with low growing stock volume the ditch maintenance increases evapotranspiration, but in stands with a high stock volume evapotranspiration is less affected. The effect of the ditch maintenance on runoff is twofold: after the maintenance the fraction of subsurface runoff increases, whereas the fraction of surface runoff decreases. Because of increased evapotranspiration, the net effect of maintenance is that runoff volume is decreased. The results show that ditch maintenance has a smaller effect on peatland hydrology than the initial drainage.