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Climate-smart forest management may decrease vulnerability of forest carbon to disturbances

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Natural disturbances like windthrows or forest fires have an effect on the provision of ecosystem services like timber production, protection from natural hazards or carbon sequestration. After a disturbance, forests release large amounts of carbon and therefore change their status from carbon sinks to carbon source. However, forest management may improve the forest capacity to absorb carbon by decreasing the vulnerability to disturbances. In this study we used simulation tools ForestGALES (windthrow) and FlamMap (forest fire) to model the vulnerability to the two disturbances. We analysed forest stands prone to windthrow (in the Carnic Alps) and forest fire (in the Apennines) and proposed forest management in the most vulnerable forest stands, increasing their resistance to the respective disturbance. We simulated the future carbon stock and sink under two scenarios: (1) business-as-usual management, and (2) forest improved using climate-smart forest management to decrease the vulnerability to disturbances. Forest under business-as-usual management led to a decrease in total carbon. Using climate-smart management compared to business-as-usual resulted to an increase of carbon stocks (with additional increase in case of no disturbance). We showed that using disturbance simulation tools may help in decision making process to analyse the most vulnerable forest stands. In combination with simulations of future scenarios of carbon we may be able to direct the climate-smart forestry.