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Evaluation of the effect of the 2011 Tsunami on coastal forests by means of multiple isotopic analyses on tree-rings

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The 2011 Mega-Tsunami destroyed at different degrees the coastal forests in eastern Japan, which for decades have protected inland agriculture and livelihood of the inhabitants in this region. This study investigates the effect of the tsunami on coastal forests and the physiological processes involved by means of stable isotope ([U+F064]13C, [U+F064]15N and [U+F064]18O) analysis for the period 2002-2014. Based on the results, annual tree-ring width from 2011 to 2014 decreased approximately 80% compared to the period previous to the Tsunami (2002-2010). Considering that soil salt concentration drastically decreased in September 2011 after a typhoon that dumped 350 mm of rain, the impact appeared to be limited in time. Nevertheless soil electric conductivity showed that spatial variability was strongly correlated with tree mortality in the study plot. The multiple isotope analysis showed that the reduction in growth was associated with a reduction in 13C discrimination following stomatal closure caused by soil salinity in 2011. Two years after the tsunami photosynthetic recovery, implied from decreasing values of [U+F064]13C in tree-rings, did not translate in tree-growth, indicating a shift in carbon allocation strategy as trees recovered from the strong disturbance caused by the Tsunami.[U+F020][U+F020]Tree-ring [U+F064]18O did not show the abrupt increase observed for [U+F064]13C and could not be used as an indicator of soil salinity. No changes in tree-ring [U+F064]18O compared to [U+F064]13C should indicate an increase in assimilation rates but that was not supported by the limited tree-ring growth or by the subsequent recovery of [U+F064]13C. Nitrogen availability did not change before and after the Tsunami as suggested by values of tree-ring [U+F064]15N which agree with values found in previous studies. The lack of the effect of salinity on tree-ring [U+F064]15N could be related to the lack of changes in soil layers where inorganic nitrogen is found and/or because of the salt resistant mycorrhizal fungi typical of Japanese forests.