

## Geomorphological influences of the tsunami and river floods on the lower Natori River unprotected floodplain

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The lower reaches of the River Natori were attacked by the tsunami disaster of the 2011 Tohoku Earthquake. The unprotected floodplain along the river is traditionally used for farmlands. This study aims to discuss the geomorphological influences in the unprotected floodplain on the degree and types of damage to the farmlands caused by the tsunami flood and river floods after the tsunami disaster. The tsunami ascended more than 8 kilometers from the river mouth in the present channel. It ascended about 6 kilometers on the unprotected floodplain whose surface is 1 to 4 meters higher elevation than the present river channel. On the floodplain micro-landforms such as shallow ditches of former channels and relatively higher parts of islands are well preserved without artificial change. The tsunami flood ascended selectively through the shallow ditches in the upper part of the tsunami affected reaches. On some islands farmlands survived from the tsunami flood. After the tsunami disaster three times of river floods attacked the floodplain in September 2011 and May and July 2012. The fresh water of the river flood washed away the salinity of the tsunami sediments in the surface soil. It is good for growing vegetables in the floodplain. However, flood water ponded in the shallow ditches every flood event and it continued for a longtime. This severely damaged farmlands.

Keywords: tsunami flood, river flood, 2011 Tohoku Earthquake, unprotected floodplain, micro-landform, River Natori