Assessment Method of Tsunami-resistant Performance / Disaster Mitigation Effect by Nature / Local Infrastructure (Study period: FY2014 to FY2016)

KATO Fuminori (Dr. Eng.), Head, HARANO Takashi, Senior Researcher, HAMAGUCHI Kohei, Researcher
Coast Division, River Department

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1. Introduction

In the areas hit by relatively low tsunami in the Great East Japan Earthquake, damage in the hinterland was mitigated by dunes or the coastal trees above them in some areas. Thus, NILIM has been studying the performance of trees etc. above the dune to control erosion of the ground and the demonstration limit of such performance in order to establish an assessment method for the disaster mitigation effect of hinterland formed by nature / local infrastructure such as dune or beach ridge.

2. Outline of the study

We conducted a hydraulic experiment to study the subject described above. Further, in order to study the assessment method for the disaster mitigation effect of hinterland, we conducted numerical simulations using the results of the hydraulic experiment. The study we conducted is outlined as follows.

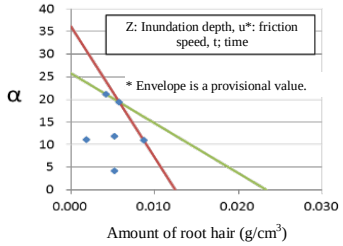
We set the ground sampled from the actual coastal trees etc. as specimen in the experimental channel and made the water run over the surface of the ground at the maximum speed of 7 m/s (see Photo) to simulate tsunami and measured the volume of erosion. Some existing studies on the volume of erosion in river levees show that the performance of erosion control is closely related to the volume of plant roots. In this study as well, we organized the relational expression between "α" representing erosion control performance (the greater the value, the more vulnerable to erosion) and the volume of roots (see Fig. 1) and showed that the maximum value of α is approximately 30. It is also suggested from the relational expression of Figure 1 that α on the site can be estimated by surveying the amount of root hair and vegetation condition.

Photo: Sampling (left) and flow experiment (right)

Next, the disaster mitigation effect of dunes etc. is assessed by calculating simultaneously erosion by tsunami and inundation by tsunami using α obtained from this experiment. Figure 2 shows an example of the calculation. When a dune is lost by the overflow of tsunami without consideration of the effect of trees etc. (Left), the maximum inundation depth is not less than 2 m, while when the dune remains due to the effect of trees etc. (Right), the maximum inundation depth is less than 2 m in almost all the areas except the sea side of the dune. The effect of reduction of wetted surface area, etc. can also be assessed similarly.

3. Conclusion

We are going to organize the findings from this study with respect to assessment method of disaster mitigation effect on hinterland by coastal forests including dunes, and simple estimation method of α.



Set the envelope to the maximum (Red) and the minimum (Green). The larger the inclination, the greater the amount of root hair.

Figure 1: Relationship between coefficient α from hydraulic experiment etc. and the amount of root hair

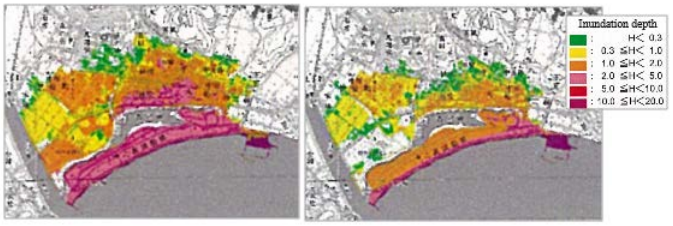


Figure 2: Inundation depth when the erosion control performance of trees etc. is not considered (Left) and is considered (Right)

☞See the following for details.

1) **Numerical Modeling Implementing Disaster of Coastal Dikes in Sediment Transport Model and Tree Roots and Numerical Experiments on Land Remaining** http://doi.org/10.2208/kaigan.72.I_745
2) Hydraulic Experiment on Using Non-disturbed Actual Scale Samples Containing Vegetation as Trees
http://doi.org/10.2208/kaigan.72.I_1687