Analysis of conditions for growth of vegetation in estuaries and application of the results

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1. Introduction

In riverine estuaries, halophytes, reeds and other vegetation which are characteristic of such areas grow thickly, contributing to the formation of the ecosystem. Clarifying conditions for the growth of these types of vegetation will contribute to appropriate river management which considers the environment of riverine estuaries.

This report introduces the results of research intended to generalize preferences in reeds and halophyte communities.

2. Relationship between vegetation, ground level, and average submersion depth

We have investigated the Natori River, Ibi River, Yodo River, Ota River (Ota River Floodway) Yoshino River, and Chikugo River, all with differing characteristic such as the scale of their tides. Based on the results of topographical surveys (grid point surveying at 50m intervals and vegetation boundary line surveying) and vegetation surveys carried out by various local management offices in 2009, elevation and vegetation data were organized in 10m meshes by interpolation using GIS to analyze their mutual interrelationships. We have normalized the elevation using the equation defined below.

$$\text{Ground level relative to tidal oscillation} = \frac{\text{ground level} - \text{synodic mean low tide level}}{\text{synodic mean high tide level} - \text{synodic mean low tide level}}$$

Reference document [1] shows the results of an analysis for each community in each river. We defined the mean submersion depth as the value obtained by dividing the total depth of submersions through the year at each ground level by the submersion time ($\int$(water level – ground level)dt/submerged time) , analyzed the relation between the ground level relative to tidal oscillation and the mean submersion depth in each district surveyed, and plotted the ground levels at which the reed communities begin to grow and at which their area of growth was largest (peak) in the figure. (In case of the Natori River, the peak is not clear, so it is not plotted.). Although there is some scattering, excluding the Chikugo River where the tides oscillate greatly, growth began at mean submersion depth of 40 to 70cm, and the vegetation growth area peaked at between 15 and 30cm.

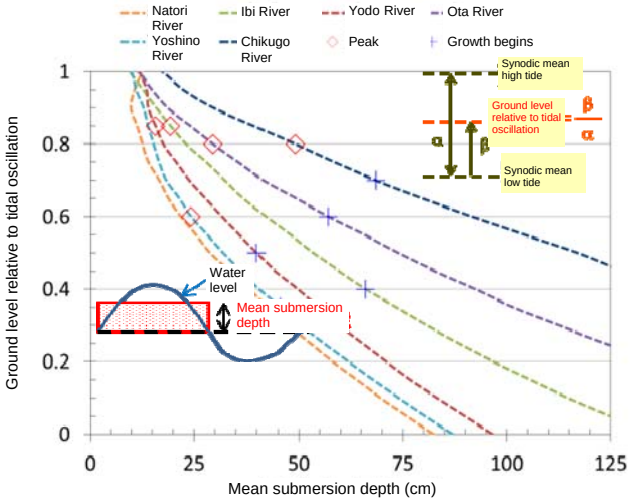

Figure Relationship of the Ground Levels where Reed Communities begin to Grow and where they Peak with the Mean Submersion Depth

3. Utilization of the results

In the Ota River, the Chugoku Regional Development Bureau constructed experimental tidal flats for restoration with three types of cross section shapes (completed in March 2010). At that time, it was designed based on the results of a survey of the ground level etc. of halophytes growing thickly in the upstream part of the test area, and the area of growth of Artemisia fukudo and other halophilous plants are gradually expanding. As the above shows, the progress of the research on conditions for the growth of vegetation can contribute to the appropriate river improvement and construction of tidal flats considering the environment.

[Reference]

1) Onuma, Endo, Amano, Kishida: Distribution of vegetation and analysis of its relationship with the tide level on shorelines of brackish water areas in

rivers, Collected Reports on Hydraulic Engineering, Vol. 55, 2011.
2) Onuma, Fujita, Mochizuki, Amano: Research on the framework of river mouth tidal flat design and management methods taking the discharge channel on the Ota River as an example, Collected Reports on River Technology, Volume 17, 2011.