Research of Historical Graphical Data for Tracking Environmental Changes of Lake Biwa Shores

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Research Overview

The reed beds in the shore areas of Lake Biwa serve as the spawning ground of fish. They also purify the water by absorbing nutrient salt. Thus it has drawn attention in recent years as an essential space for maintaining the aquatic environment of Lake Biwa. Also, the reed beds, if left neglected, becomes sedimentation and transition to other vegetation. It is important as “secondary nature” maintained by humans who cut it for roofing material.

In our research, we use reed beds as an indicator of environmental changes at Lake Biwa, and seek to create a long-term reconstruction of the lake’s changes in area and landscape using historical materials such as maps of the early-modern period.

We have been using aerial photographs and topographical maps to analyze the change in the landscape of Lake Biwa and carry out reconstructive research. However, aerial photographs date back to only 1945, and topographical maps to 1893, so their use in reconstruction is limited. On the other hand, in Shiga prefecture there is a great number of early-modern and modern pictorial maps of villages. We believe that we should study the possibility of using these materials to analyze the aquatic environment and landscape of Lake Biwa.

The object of our research here are maps created of all the villages in the former Hikone Domain in 1871. In addition to land use information during the time of its creation, the map also recorded old land use information based on land surveys from the early-modern period. Thus it is possible to reconstruct the distribution and size of reed beds in the shores of Lake Biwa during the later stage of the Edo period and the beginning of the modern period. Also, because the map encompasses about 30 villages, it is possible to reconstruct the lakeshore environment of the east part of Lake Biwa. By plugging the reconstructed data into a geographic information system (GIS), we could connect it with digital data obtained from aerial photos and topographical maps after the Meiji era. We can quantitatively understand and study more than 200 years of changes in landscape and environment of the shores of Lake Biwa.

Current Progress and State of Reconstructed Landscape Map

From April to July 2009, we scanned base maps of the target region and pictorial maps from the Meiji era. The base maps used were national basic maps (S=1/2500) from a 1962 survey. Forty-seven of these maps were scanned at 300dpi in the TIFF format, and then processed. Using ArcGis 9.3.1, we defined the GCP of the four corners of the map boundary, and performed affine transformation using first-order polynomials.

Currently, we could confirm the existence of 47 villages in the maps representing the Hikone Domain, the focus of our analysis. We are continuing the study for six villages that still cannot be confirmed. Ninety-five of the maps of the Hikone Domain were scanned at 1600dpi in the TIFF format. Wastelands (marshes), and are currently studying the long-term dynamics of changes in the shore environment of Lake Biwa, with a primary focus on changes in the shoreline and reed beds.

Since August, we have been working on landscape reconstruction using ArcGis 9.3.1 together with land use information deciphered from the Hikone Domain maps. We have completed two-thirds of our expected goals. As an example of the results of our analysis, Figure 1 shows the distribution of reed beds in the southern part of the target region in the late Edo period. We have also completed a map of the early Meiji period using the same parameters. We have reconstructed the village boundaries, land regions, water regions, reed areas, and wastelands (marshes), and are currently studying the long-term dynamics of changes in the shore environment of Lake Biwa, with a primary focus on changes in the shoreline and reed beds.