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Landform Changes Detected from Satellite Images and Bottom Topography-Sediment Distribution in the Upo Wetland, S. Korea

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Introduction

Upo wetland is located in S.Korea, and the longitude is E128°25' and the latitude is N35°33'. The toal area of Upo wetland is about 8.54km^2. At high discharge during the wet season(July~August) the area contained water is about 2,314 km^2. Upo wetland appointmented as a 'Ecological conservation Area' (1997. 7. 26), but main documents and papers about this area have not been reported.

The goal of this research is to interpret the origin and development of the Upo wetland. But there was no preceding study and data and we carried out for the first time satellite image processing, lake geodetic survey and bottom sediment acquisition to explain the landform characteristics and environmental condition of Upo wetland. The characters of flow direction and sediment distribution in Upo wetland were covered by the bottom-topography(landform) surveying and grain analysis.

Methods

We carried out remote sensing analysis to detect the changes that affect sediment budget in Upo wetland. PCA(principle component analysis) in remote sensing is an algorithm to compress all of the information contained in a original data set into fewer than n-component. The concepts involved in PCA may be expressed simply and graphically by four-wetland image data sets (9. 5. 1984., 5, 9. 1994., 4. 18. 2001., and 4. 5. 2002. Landsat images). To multi-spectral image data process, the first principal component(PC1) includes the largest percentage of the total scene variance and each succeeding components (PC2, PC3...PCn) contain a decreasing percentage of the scene variance.

To obtain the bottom-topography data we use the GPS (Legacy-E type) that supports the three mode, Static, Rapid Static, and Kinematic & RTK(Continuous mode and Stop & Go mode). We measured the height of water level and sounded the depth at the interval of every 50m in east and west direction, and 100m in north and south direction. We extracted 79 bottom sediment samples to perform grain size analysis.

Results

Analysis of satellite images

We used PCA(Principal component analysis) method to detect the environmental changes from four Landsat images during about 20 years. As a result we found

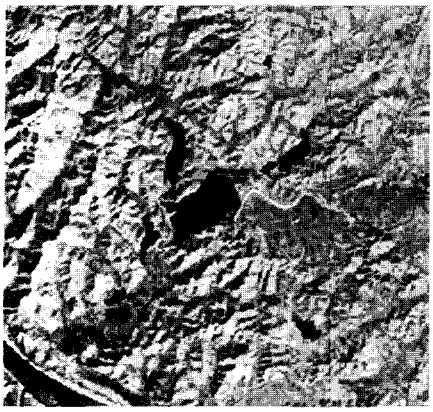

Fig. 1. 9. 5. 1984. Landsat image

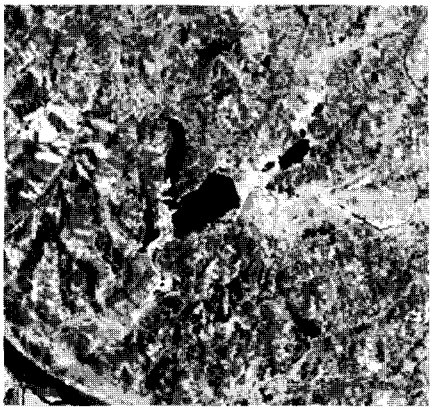

Fig. 2. 5, 9. 1994. Landsat image

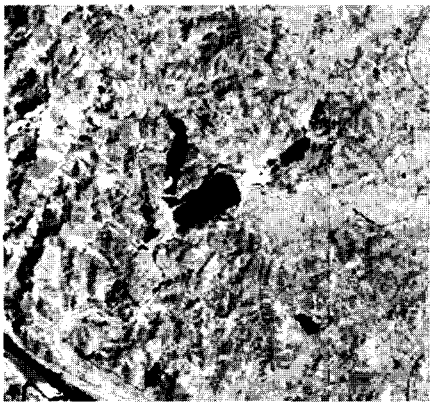

Fig. 3. 4. 18. 2001. Landsat image

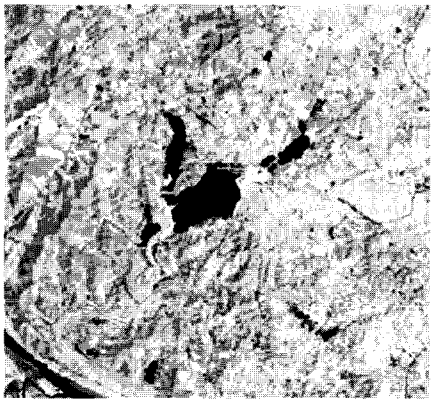

Fig. 4. 4. 5. 2002. Landsat image

Fig. 5. PCA analysis (four image complied)

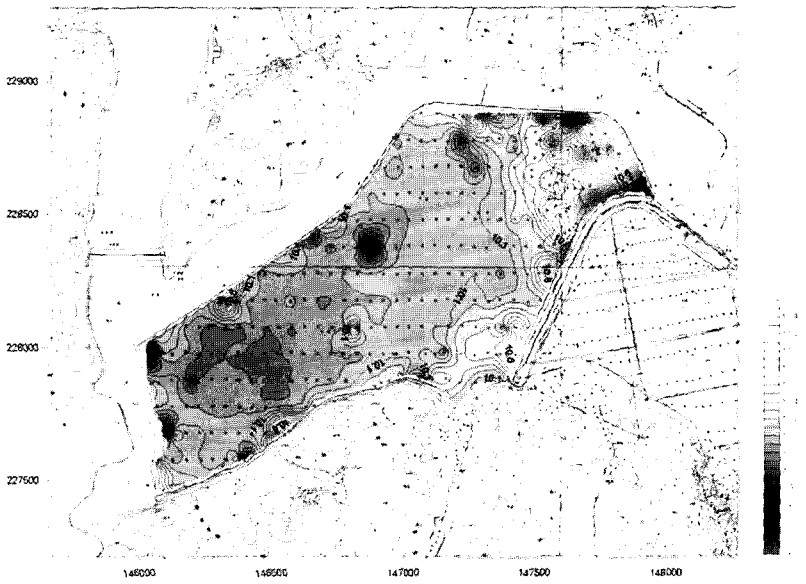

Fig. 6. Situation of the surveying in Upo wetland

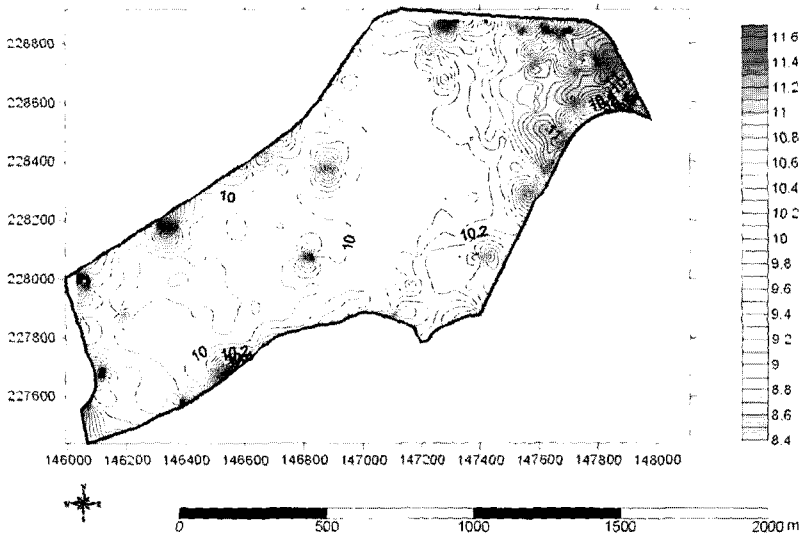

Fig. 7. Height contour of bottom in Upo wetland

as follows ; 1) there were little changes of geomorphic and landuse for this term, so we didn't search the decadal events from bottom surface sediment, but can prospect to detect the long term events from drilling core analysis. 2) the boundary of plant group underwent a seasonal change that is related to the depth of a water.

Surveying bottom topography with GPS (Legacy-E type)

We obtained the bottom topography of Upo wetland from surveying with GPS. With the raw data, we embodied 3D-bottom topography. The characters of the bottom-landform are as follows ; 1) the shape and

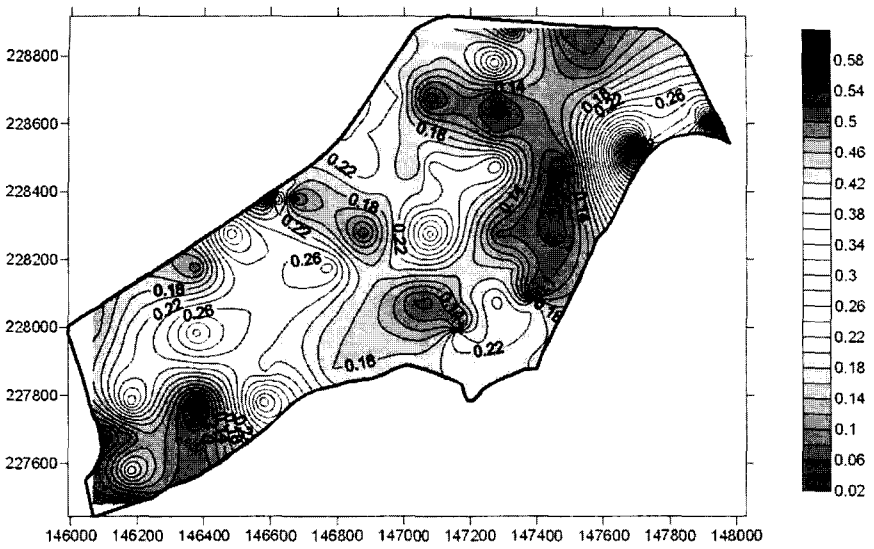

Fig. 8. The contour map of D50 in Upo wetland

sediment process of bottom near the inflow is like delta, and this place especially show the highest bed-gradient and the most complicated cross-sectional shape in Upo wetland. 2) the bottom topography of the middle and outflow section is relatively flat.

Grain analysis and spatial distribution pattern

We performed grain size analysis to know the characters of the bottom sediment distribution at 79 spots, and computed D50. The spatial distribution pattern of grain size of bottom sediments in Upo wetland is as below ; 1) the lake bottom consists mainly of fine sand and silt, 2) Near the inflow part, the farther from the inflow, the finer the sediment size is likely to be. 3) The sediments along subsurface bottom flow in the Upo wetland show relatively coarser than other parts. 4) Along the bottom flow in the Upo wetland, the grain size of bottom sediment changes horizontally very rapidly changes.

In this study, the NE-SW linear bottom flow is assumed during the ordinary period, but during the stormy season and the flash flooding period, bottom flow is majorly turbid and hummockty bottom land-form was assumed due to increasing lake level, input of flash flooding from sides of Up wetland as small distributaries were flooded.

Conclusions

We performed from this study satellite image analysis, geodetic and echo-sounding survey and grain analysis to interpret the process and development of the Upo wetland. As result we conclude as follows ; 1) image analysis did not show decadal changes, but we are detecting the long term events affected by human intervention from drilling core, 2) we suppose that bottom flow pattern reflects in the patterns of coarse and fine sedimentary distribution patterns in Upo wetland, 3) it is necessary to do monitoring the present environment in the Upo wetland and srrounding areas to understand decadal changes of landform. Lastly it suggected that further research is necessary to prove it with the help of detailed field measurements and experiments.