

# Flood Hazard Map in Kumagaya City

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**Abstract :** We made a hazard map using GIS and remote sensing for the greatest inundation damage that happened for the 20th century. We calculated the land cover classification using Landsat from 1983 to 2000. We calculated it from a damage report and an aerial photo for a flood. We considered relation of both land cover classification and the damage. We expected the inundation damage in the future and made a hazard map.

**Keywords:** Hazard Map, GIS, Inundation Area

## 1. Introduction

To make a hazard map is one of the most important task to the administration currently in order to keep the life of victims and their property. In spite of the inundation damages of Tonegawa and Arakawa Rivers in the past, in Kumagaya city, we have no hazard map of flood at present. Then, we made a flood hazard map which can be expected in the future from the past inundation damaged area.

## 2. Method

### 1) Study Area

Kumagaya city is located in 64km northwest, from Saitama, and including three railways: the Joetsu Shinkansen, Japan Railways Takasaki Line, and Chichibu Railway and four lines: National route and 17 (old Nakasendo), 125, 140, and 407, in the city. It is a traffic foothold of the north

prefecture, and about half of land use is an urban area.

### 2) Used Data for Flood Hazard Map

(i) The inundation actual map in August 1910, September 1947, and September 1958

(ii) Digital map 25000 (map image)

(iii) Landsat-TM data: February 25, 1997 for the fallow season, and August 4, 1997 for the cultivation season.

( ) Rainfall data: September, 1947 and September, 1958

### 3) Procedures

In creation of a hazard map, the past actual inundation area maps were used, and read with the scanner and geometrically corrected using the digital map 25000. Next, these maps were digitized using ArcGIS. The target inundation was August 1910, typhoon (Fig.1), September 1947, Kathleen typhoon (Fig.2) and September 1958, Kanogawa Typhoon (Fig.3). The reason why we collected was that the damage was the most serious and it was generally officially announced as inundation an actual map.

The inundation area was trimmed with the contour line for 1910, and with the watershed for 1947 and 1958 using 50-mDEM. The paddy field was extracted from the land use of digital map 25000 (map image), a topographic map 50000, and the land cover classification from Landsat TM.

Finally added the paddy field to the flood region polygon, the hazard map was made of the three maps (Fig.4).

### 3. Results

#### 1) Land Cover Classification

The land cover classification was carried out from Landsat-TM data. When creating a land cover classification map using Landsat-TM data, it is difficult to classify a paddy field and a crop field with sufficient accuracy from one period of the data. Therefore, it classified using the two periods of data for the fallow and cultivation seasons. Classification items are paddy fields, crop fields, forest, bare soils, urban areas, and water areas. Land cover classification result in Kumagaya City was shown in Fig.5, Table.1.

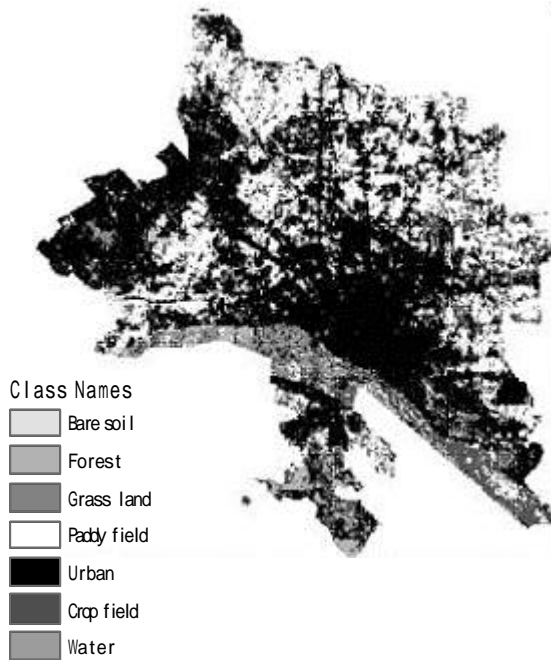


Fig.5 Land Cover Classification

Table.1 Land cover ratio unit:(%)

Paddy field	Crop field	Forest	Grassland	Bare soil	Urban	Water
31.2	12.8	26	4.1	39	44.9	0.4

#### 2) Inundation Actual Map

The inundation area, in 1910 and 1947 showed that covered the whole area in Kumagaya City. The inundation areas for both years were quite similar. In 1958, the east side of Kumagaya City was mainly the inundation area. The inundation areas were shown in Fig.1, 2, and 3 for 1910, 1947, and 1958, respectively.

#### 3) Hazard Map

The inundation areas in 1910, 1947, and 1958 were combined, as a hazard map, shown in Fig.4.

### 4. Consideration

There are characteristic patterns in inundation area of 3 floods, respectively. It is necessary to compute the drainage division, of sewerage and its capacity on the basis of watershed, and to make inundation areas in creating a future hazard map.

### 5. Conclusions

The inundation area in Kumagaya city was extracted from the past inundation actual maps. The inundation area was trimmed on the contour line and the watershed boundary. The partial inundation area was shown in 1958 while the inundation areas in 1910 and 1947 were trimmed on the contour line and the watershed boundary. We would like to add the existing highways, railways, buildings and evacuation routes as elements, and to create the realistic hazard map considering the drainage divisions of the sewerage based on watershed boundary. Namely, in the flood damage in 1910, river improvement and sewer networks were undeveloped, the inundation area was shown on the contour lines. But, in the flood damage in 1947, river improvement was advanced, and the inundation area was trimmed on the watershed boundary. On the other hand, in the flood damage in 1958 the sewerage was spreading, and the sewer drainage areas cut the inundation area.

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Fig.1 Inundation Actual Map in August, 1910



Fig.3 Inundation Actual Map in September, 1958



Fig.2 Inundation Actual Map in September, 1947

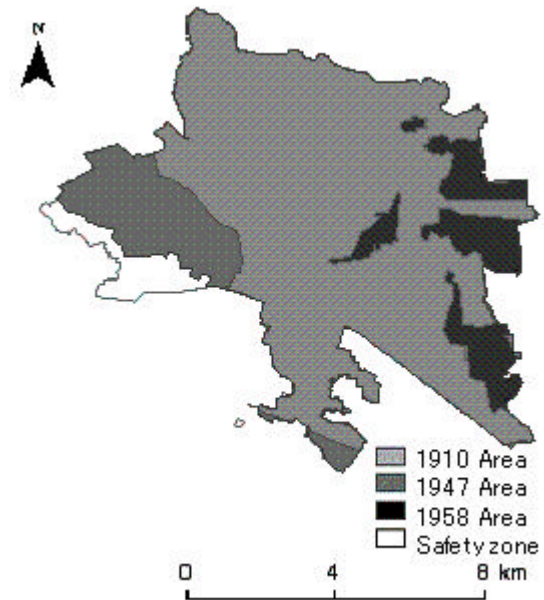


Fig.4 The proposed hazard map