RICE HECTEREGE ESTIMATION / CULTIVATION MAPPING USING REMOTELY SENSED DATA AND GIS FACILITIES

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ABSTRACT:

Concerning to the Rice as a main crop in Iran, having the correct knowledge on the cultivated areas and it's contribution is very important for Ministry of Agriculture and to this subject a provincial project has been done in 1994. In this project, analysis of TM data, GPS applications and GIS facilities were applied to define the rice hecterage and cultivation mapping of Gilan province with an area about 15000 square Km. in the northern part of Iran. The below stages have been concerned:
- Geometric correction / Mosaicking of 8 TM Quadrants covering the whole province and masking of interested area, using 1:50,000 scale Topomaps and GCP selection.
- Unsupervised classification of masked area to identify main agricultural regions and to obtain the auxiliary information for supervised classification in the future stages.
- Ground checking of unsupervised classification results and definition of the proper areas for training sites selection.
- Concerning to the noticeable forest area in Gilan, these areas were omitted to decrease the disk space and computation time.
- Pre-processing, Enhancement and classification of images to define the rice classes and hecterage estimation. It is mentioned that different data manipulation including spectral ratio, principal component analysis, filtering and the like were applied to raise the spectral separability of rice against the other crops and vegetation.
- Using GIS applications for rice cultivation mapping and preparation of 1:100,000 scale maps with 30 by 30 minutes geographic coordinates.
- Using GPS facilities for ground sample checking and accuracy estimation of the obtained results. Concerning to correctness of the obtained results, the project is being expanded for the other regions with rice cultivation activities.

1. PROJECT AREA

The Gilan province in the northern part of Iran with an area about 15000 square Km. has been selected as project area. Due to the vicinity of Gilan with the Forest region in the South / West and Caspian Sea in the North / East part, all necessary conditions for rice cultivation (soil, rainfall, rivers, ...) are provided and since a long period the rice cultivation activity was concidered in this province, and about 1/4 of the total rice production obtain in Gilan.

As shown on the plate 1, Gilan comprises the eleven township in which the rice is concidered as main crop.

2. MATERIALS

2.1 1:50,000 scale administrative maps prepared by statistics centre of Iran.

2.2 1:50,000 scale topomaps prepared by geographical organization.

2.3 8 TM color prints (Quarter Scene) covering of whole province (Plate 2).

2.4 TM digital data of July 1993.

2.5 EASI/PACE and ARC/INFO software for image processing and map production respectively.

2.6 GPS (Global Positioning System) for ground sample location.

3. METHODOLOGY

Concerning to the scope of project (crop hect-arage estimation / cultivation mapping), the procedure could be explained in three stages as below:
- Satellite data processing / classification.
- Rice cultivation mapping.
- Ground samples checking using GPS.

3.1 Satellite data processing

3.1.1 Since the TM images used in the project were raw data, using 1:50,000 scale topomaps and collection of sufficient GCP(s), the TM images were geometricsally corrected and the 8 quarter scenes were mosaicked.

3.1.2 Using 1:50,000 scale administrative maps the boundary of Gilan province was transfered to the previously corrected images and the surrounding part was ommited.

3.1.3 Concerning to the noticeable forest area in the mentioned province and no rice cultivation activities in this part, the forest area was ommited from the data file to decrease the disk space and computing time.

3.1.4 Concerning to the reed-beds and scattered small group of trees within the agricultural areas, a primary unsupervised classification was performed on the TM data to define the whole agriculture area that mainly comprise the rice cultivation.

3.1.5 The obtained results of former stage were ground checked and the proper parts were selected to be used as training sites for further classifications.

3.1.6 Using the data obtained from unsupervised classification and the areas defined as training sites, a supervised classification was performed on the raw TM bands and spectral separability of rice against the other crops/vegetation was evaluated.

3.1.7 To raise the spectral separability of rice against the other vegetation, different data manipulation inclusive of Spectral Ratio, Principal Component Analysis, filtering and the like were applied and the best data combination (two PCA and three TM bands) with the maximum spectral separability was selected.

3.1.8 Using the results of the former stage, the final supervised classification was done and the three different kinds of rice eventually were united as total rice class in the Gilan province. At the end of this stage the total area of 193557 hectars was defined as rice hecterage.

It is mentioned that, regarding to the relative confusion matrix, an accuracy of 94% was resulted for the above rice hecterage.

3.2 Rice cultivation mapping

As explained before, Gilan province is divided into 11 townships and the total rice production obtain from these townships. Therefore, after completion of the mentioned project, using GIS facilities, 1:100,000 scale rice cultivation maps relative to the different townships with 30 by 30 minutes of geographic coordinates were produced.

Since the rice distribution was concerned as main class to be depicted, on the produced maps, the other vegetation is shown as "others". The mentioned maps not only are being used for agricultural planning / crop monitoring but would be concerned as an important part of information needed for agricultural database of Gilan.

3.3 Ground samples checking using GPS

The TM digital data applied in the project were not the real time data. Therefore, to assess the accuracy of obtained results the following manner was applied:

3.3.1 Randomly selection of 5×5 pixel windows (Ground samples) on the classified images and extraction of centre coordinates of the windows.

3.3.2 In this stage, the constant geodethic points(Bench mark) installed by Ntional Cartographic Centre of Iran and by differential positioning method, the ground samples were correctly located and percentage of various types within the samples were assessed. At the end of

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this stage, according to the above samples checking, an accuracy about 90% was obtained for rice hecterage estimation.

3. CONCLUSION

The remotely sensed data particularly TM images with wide spectral range and sufficient bands could seriously be concerned to main crops identification / hecterage estimation and eventually for cultivation mapping. It is obvious that the real time data and using the GPS for sample location, would obtain the very reliable results for agricultural planning.

4. ACKNOWLEDGMENT

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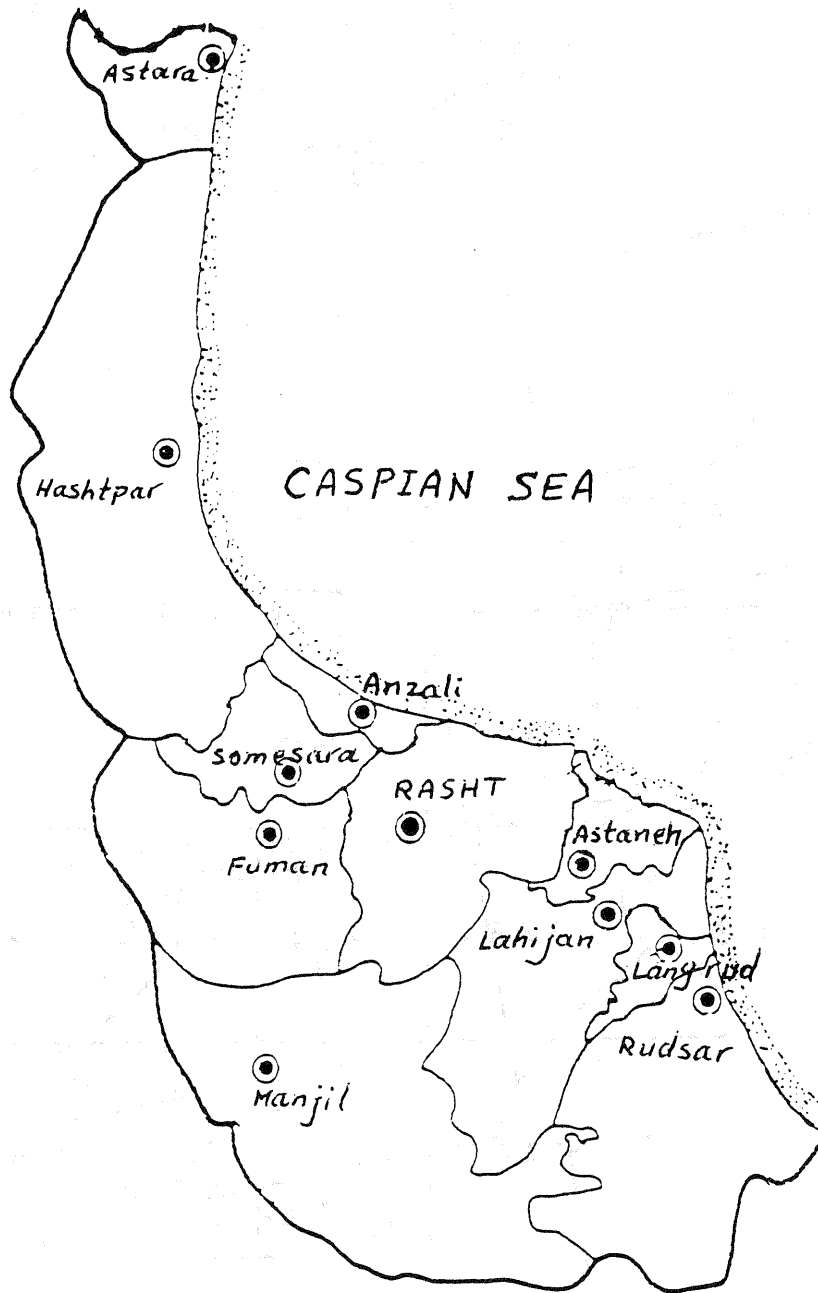
Plate 1- Administrative map of Gilan

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Caspian Sea

1

☐ TM Quadrant

☐ 1: 100000 Scale map

〜 Boundary of Gilan

5 7 6 6

5 7 6 5   5 8 6 5

2

5 7 6 4   5 8 6 4   5 9 6 4   6 0 6 4   6 1 6 4
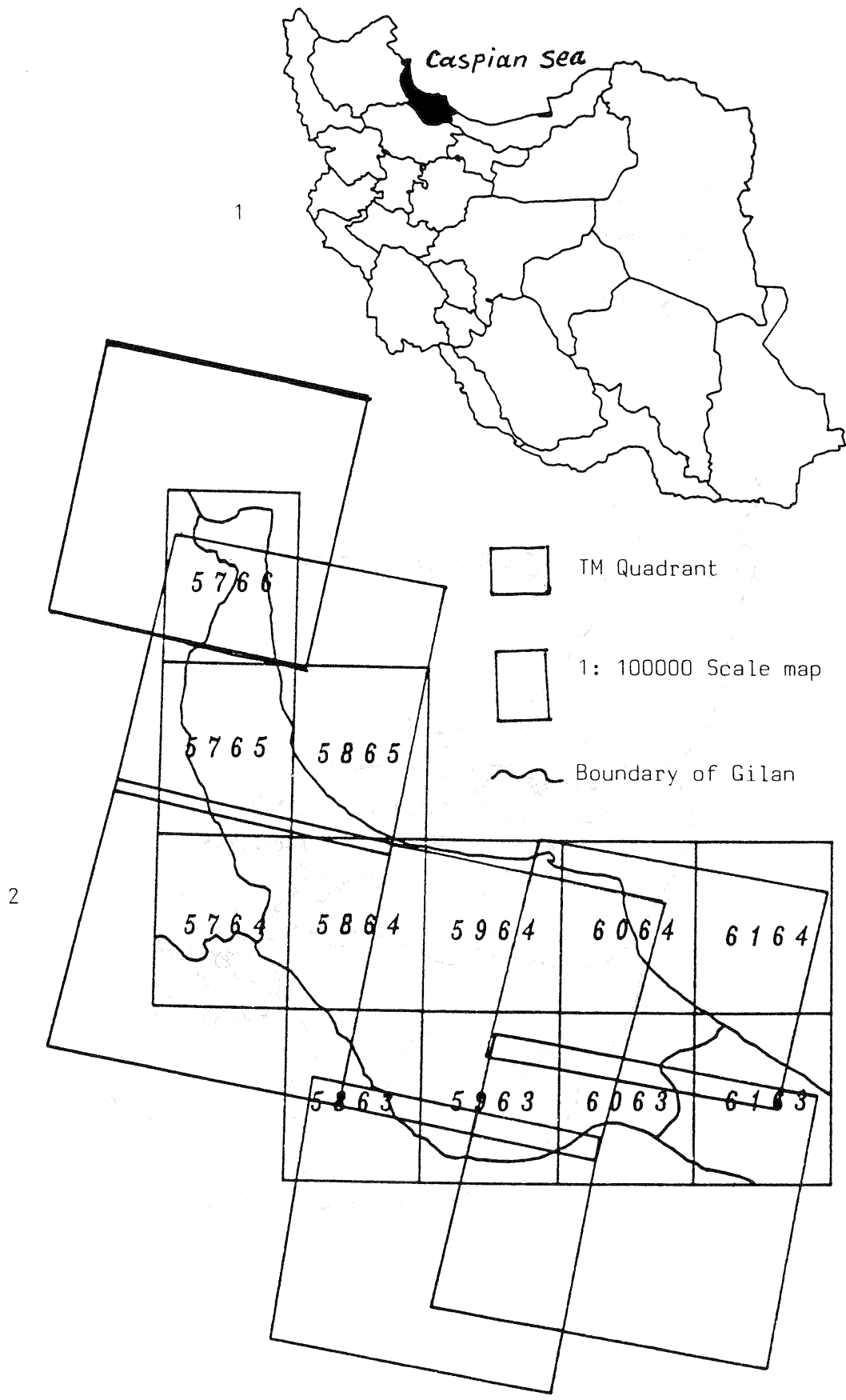
5 8 6 3   5 9 6 3   6 0 6 3   6 1 6 3

Plate 2

1- Position of Gilan on the map of IRAN

2- TM images of Gilan

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