The Preparation of Paddy Map by Digital Numbers of IRS images and GIS

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Abstract: Preparing updated map of paddy is an important map in the management and region agricultural planning. In this research, surveying of paddy investigated using IRS Satellite images in the Roudbar region, Guilan, Iran. The mean and standard deviation of training and auxiliary pixels of paddy was calculated. Upper and lower limits of DN-olive orchards were distinguished by the adding standard deviation to mean or diminishing of that. After rounding the upper/lower limits of paddy spectrum reflexes, 22-25, 40-98 and 24-136 of spectrum reflexes limits had been considered for bands 1, 2 and 3 with paddy class. In each band, Paddy limits introduced to software and slicing method used to prepare paddy map. Final map of paddy obtained from crossing of these three maps. The paddy map has been crossed by training point map to calculate the accuracy of method. The results indicate that in classification of images with spectrum reflex statistics, more than 73% of training points had again paddy class in the paddy fields classified map.
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1. Introduction

As human demands increase, the sustainability of land use is in question. Better land management involves identifying land-use changes, understanding current land-use patterns or features, and assessing economic and ecological benefits and costs that arise from land-use practices, as well as finding the best alternatives for each area (Wu et al., 2001). Remotely sensed data frequently are used to map land surface cover for use in a variety of resource assessment, land management, and modeling applications. Mapping from coarse spatial resolution images and with multispectral instruments necessarily has focused on land cover and broad vegetation types (Loveland, 2000) rather than discrimination of vegetation at a species level.

Rembold et al. (2000) investigated land cover changes in a 22 years period at Lakes region in south of Ethiopia by aerial photographs (1972) and classifying TM land sat images (1994). The analyses indicate that cultivated surface had been increased and more erosion had been occurred in new cultivated lands. Unal et al. (2004) rendered to classify cultivated land and separation of pistachio garden and orchard from the other vegetation in Gaziantep province of Turkish. Ramos et al. (2007) tried to measure and identify of soil movement in various gradient using GPS, GIS and DEM. Also, Moschen et al. (2001) tried to separate agricultural area from non- agricultural area using controlled classification of integrated images of TM5 with IRS IC PAN land sat and ERS 2 radar by maximum likelihood method. In addition to this separation, they tried to separated wheat, maize farm and rangelands.

Using AIF (adaptive image fusion) index, Fletcher (2005) used high resolution QuickBird satellite images to recognize citrus with black mold (capnodium citri) in Texas region of America and indentified it as a suitable method. Das et al. (2009) tried to prepare map for regions with reducing citrus production capacity in Meghalaya region of India using IRS satellite images. The map of regions where citrus production capacity had been reduced was prepared using soil erosion information, vegetation condition and humidity tension. Due to some changes which are created above time in paddy surface preparing updated map of paddy is one of the most important requirements in the management and region agricultural planning. With regard to this that land surveying required high cost and time and also preparing the map through aerial photographs is required to prepare aerial photograph which still along with high cost, use of satellite data along with remote sensing technique may be employed as a useful and effective tool to estimate crop area.

2. Material and Methods

The study area is located between eastern longitudes of 48°55′48″ and 49°52′54″; and northern latitudes of 36°31′19″ and 36°59′57″ that the region area is 4590 km^2. Administrative boundary of the study area includes Roodbar Township along southern portion of Guilan province, Iran. Different image processing techniques are usually available to highlight a certain land use. In present research, a technique that was employed to highlight paddy from other land covers which are going to be described by spectral reflectance stochastic (DN: Digital Number)

of different land covers and slicing. IRS images of July 2006 were used to map olive farming area and software ILWIS 3.3 Academic was used for processing data. Table 1 shows the properties of different bands of IRS images. Field views (189 points) were done to determine accurate positions of land covers including paddy, Olive, hard wood forest, soft wood forest, bare lands, other vegetation, water area and urban regions.

Table 1. Some properties of IRS bands

Band No.	Standard Deviation	Median	Mean
1	13.3	28	19.58
2	51.33	99	67.3
3	47.99	98	67.7

A training and auxiliary points map of different land covers was prepared to overlay on a sample set of color composite (bands 1, 2 and 3). The mean and standard deviation of training and auxiliary pixels of paddy was calculated. Upper and lower limits of DN-paddy were distinguished by the adding standard deviation to mean or diminishing of that ($\bar{X}(B_1, B_2, B_3) \pm 2S.d$). After rounding the upper/lower limits of paddy spectrum reflexes, 22-25, 40-98 and 24-136 of spectrum reflexes limits had been considered for bands 1, 2 and 3 with paddy class. In each band, Paddy limits introduced to software and slicing method used to prepare paddy map. Final map of paddy obtained from crossing of these three maps. The paddy orchards map has been crossed by training point map to calculate the accuracy of method.

3. Results

Table 2 indicates mean, standard deviation and upper/lower limits of training pixels spectrum reflexes-paddy in order to image slicing in bands 1, 2 and 3. As we can see, in band 1, there is a shared DN between Paddy spectrum reflexes and the other surface covers including Olive, other vegetation, hard wood and soft wood forests, and approximately barren land. In band 2 of IRS satellite image, the greatest spectrum reflexes interference with paddy class in vegetation cover, Olive and then soft wood forests in found. In this band, in $\bar{X}(B_1, B_2, B_3) \pm 2S.d$, spectrum reflexes interference of hard wood forest, bare lands and urban regions had been lasted, but DN interference of water zones with paddy is seen. Also, in band 3, there is interference between broad leaf wood, vegetation cover, Olive orchards with paddy, but soft wood DN interference and water zones with paddy had been lusted.

Table 2. Upper and lower limits of spectral reflectance by the mean and standard deviation of spectral reflectance in training and auxiliary points of surface covers

Surface cover \ Band number	$\bar{X} - 2S.d$			$\bar{X} + 2S.d$		
	1	2	3	1	2	3
Paddy	22.4	40.8	97.4	24.9	62.5	135.9
Olive	22.5	51.3	90.0	25.7	77.9	114.7
Other vegetation	23.0	48.7	81.5	26.6	78.7	116.5
Hard wood forest	22.4	31.0	81.4	24.4	39.7	136.6
Soft wood forest	22.4	51.2	48.5	24.4	65.1	61.3
Bare lands	24.8	89.7	74.5	30.2	129.0	105.5
Water area	25.0	57.6	24.8	26.4	67.2	38.0
Urban	23.6	81.0	72.4	32.0	127.5	102.8

* Digital Numbers Mean of Training Points in Olive Orchards Class

** Digital Numbers Standard Deviation of Training Points in Olive Orchards Class

Table 3 indicated the crossing result of training points map with paddy map. According to results, more than 73% of training points in classified paddy map recognized as paddy class. Only 8.5% of training points of soft wood forest class in classified map of paddy by slicing method had paddy class. Also, no one training points soft wood forest were not placed in classified map of paddy class. Also in surface cover classes of barren lands, urban and water, none of the training pixels classified in paddy class. Spectrum reflexes interference of Olive with paddy had been found, so that, 38.8% of training pixels of Olive in the classified map had paddy class. 45.0% of training points in other vegetation were also classified as paddy in classified map.

Table 3. Crossing classified map of olive orchards by training points map

Surface cover	N_t*	N_{t-o}**	N_{t-o}/N_t***
Paddy	1502	1107	73.7
Olive	2016	783	38.8
Other vegetation	293	132	45.0
Hard wood forest	10884	932	8.5
Soft wood forest	208	-	-
Bare lands	38734	-	-
Water area	1134	-	-
Urban	8597	-	-

* Total numbers of training points
** Numbers of paddy class-pixels after crossing classified map of paddy with training points map
*** Paddy class-pixels/total pixels ratio (%)

4. Discussions

The aim of current study was to separate the paddy regions from the other surface areas. In various regions, the type of surface phenomenon impact on map accuracy from classification, intensively. For example, separating of water zones in IRS 3-bands images from surface phenomenon maybe possible, simply which in turn have its own certain condition, so, when the issue of separation one vegetation from the other vegetation is consider the possible of separating is most difficult.

In this research, paddy consider as one class and the other vegetation including orchards, woodlands, garden and etc had been considered in another class by the title of other vegetation. Also, the vegetation of broad-leaf (hard wood) forest and conifer (soft wood) forest each consider in separate classes. With regard to the results, separating paddy helping spectrum reflex statistics cause to separate paddy from forest zones, well. Of course it must consider that, in each of spectrum bands, there is wave interference of some of surface covers, so considering 3 spectrum bands with each other, caused to reduce the interference of reflexes and to increase the possible to separate paddy. Cuneo (2009) provided a map of African Olive distribution was produced from the image analysis and checked for accuracy at 337 random locations using ground observation and comparison with existing vegetation maps. Results indicated that a total area of 1907 ha of dense African Olive infestation was identified, with an omission error of 7.5% and a commission error of 5.4%. Sepulcre-Canto (2009) monitored a total of 1076 olive orchards in area in southern Spain, gathering the field location, field area, tree density, and whether the field was drip irrigated or rainfed by. An approach based on a cumulative index using temperature and the normalized difference vegetation index (NDVI) information for the 6-year ASTER time-series was capable of detecting differences between irrigated and rainfed open-canopy orchards, obtaining 80% success on field-to-field assessments. The method considered that irrigated orchards with equal vegetation cover would yield lower temperature and NDVI than rainfed orchards; an overall accuracy of 75% and a kappa (kappa) of 0.34 was obtained with a supervised classification method using visible, near infrared and temperature information for the 6-year ASTER imagery series.

The results indicated that there would be possible to separate paddy spectrum reflexes from broad leaf forest (hard wood forest), conifer forest (soft wood forest), urban and residential regions, bare lands, ranges and water zones, but because of intensive spectrum reflexes interference, there was not this possible in separate the paddy from other vegetation including the other orchards, woods and parks green spaces.

5. Conclusion

Paddy mapping by spectrum reflections statistic only focusing on paddy spectrum reflexes statistic, the likelihood paddy regions had been separated and preparing the maps is done with regard to goal, that is, paddy and the other surface covers are not consider. As a whole, it seems that, if preparing the map of paddy is doing with the help of spectrum reflexes statistic in the regions with paddy and other vegetation, the separated area must indicated under the title of mixed paddy, olive and other vegetations.

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