ANALYZING RULES WITH OBJECT-BASED ANALYSIS TO IRRIGATED RICE CLASSIFICATION: A CASE STUDY OF NONGYASAI DISTRICT SUPANBURI PROVINCE, THAILAND

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ABSTRACT: The fertile central plain of Thailand is suitable for agriculture, particularly the irrigated rice. The authors analyzed multi-temporal satellite images Landsat-5 on July 27,2011, October 15,2011, October 31,2011, to obtain the irrigated rice acreage of Nongyasai, Supanburi province. This was performed with object-based analysis, including Vegetation Indices – NDVI, NDWI and Band Ratio, by analyzing a given rule set equation,And then classifying the outcomes in terms of segmentation and rice growth period, from seeding stage up to the harvesting period. The results showed that the rule set and analysis led to satisfactory answer and fulfilled the classification objecttive of irrigated rice growth period, including the application of satellite data analysis in the other field.

INTRODUCTION

Rice, one of the staple food for global population, is classified as one of the species of grass. However, this is the largest, along with biological diversification, grass in the world. Rice may be grown in different climate condition, particularly in the water-filled area which is called irrigated rice. Irrigated rice is grown in the irrigated area, on an annual basis or may be multi-grown annually, under the controlling of water. Rice in the central plain of Thailand belongs to two types; short and medium height, reaching some 100-130 cm., and, those are non photo-sensitive rice. At present, rice is in great demand from both domestic and global consumption. It generates billions of baht and is the leading cash-crop among other economic crops in Thailand.

The study of the acreage by field trip consumes a lot of time and leading expenses. In order to find more effective methodology, satellite data were analysed giving far more coverage, including more frequency, especially in the monitoring of change in a given period of time. It in considered as one of the best methods to appraise the acreage of irrigated rice in Nongyasai, Supanburi province, Thailand. The method of Expert classification technique, with important numerical data sets, including NDVI data, NDWI data, band ratio data, of Landsat-5 was used in the study

DESCRIPTION OF THE STUDY AREA

The study area, (14°46′30″N, 99°54′40″E), covers an area of about 420.21 sq.km., with some 99.53 sq.km. in irrigated area. Generally, this area consists of a dry highland topography with only one stream passing through. However, this area produces the highest output, up to 977 Kg.. per rai (977 Kg /0.16 hectare) The growth period normally starts from August and ends in November or December in each year, totalling around 110-120 days. There are three periods of growth; seeding with some 20 days, reproduction period from blooming, young seed, then reproductive process for some 30-35 days and the mature period, from fertilization until the harvesting period for some 25-30 days

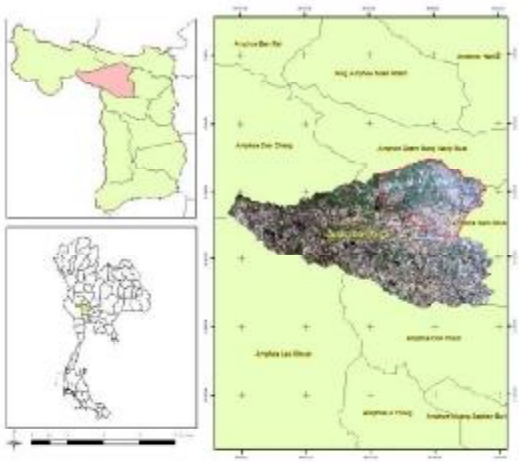

Figure 1 : The location of the study area.

METHODS ANDEQUATION

1. Geometric Correction

The method used for geometric correction was Image to Image technique. The rectified image, which has been through Ortho-Rectification process, has been used as the reference image. Ground control points were set for at least 16 points per image, and these points need to be spread all over the image. The image was rectified with an equation of polynomial level 2. RMS Error was set to be no more than 1 pixel. Nearest Neighbor was used as a randomizing method. The output image was set to have a resolution of 25x25 meter.

2.ImageClassification

The authors create image objects by segmentation on Definiens Developer Program. First, by using the basic non classification of image and scale parameter as 10, with 0.4 shape and 0.6 compactness; this program will automatically process the data from the given parameters into groups. Then, the pixel of image with similarity will be grouped. After that, the authors use NDVI data ,NDWI data and Band Ratio from the study area to be sample of the reference in order to find the appropriated value in rule setting for the classification in each period.

3.Analysis and Check for Accuracy

After classification of LandSat-5 satellite data, all three temporal images, then the authors proceed to check the accuracy, by comparing with the data from Land Development Department (LDD), taken in 2010, by accuracy assessment of the results from pixel-based classification

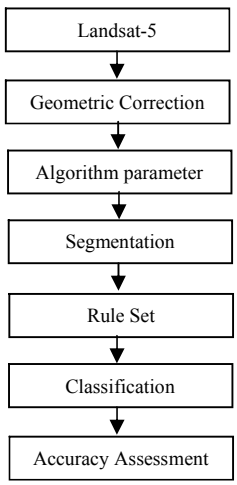

Figure 2: The process

RESULTS AND DISCUSSION

From analyzing of the three-period of LandSat-5 temporal satellite images, the authors use 0.4 shape and 0.6 compactness as the most appropriate given value, in order to find the segmentation of the study area. From the classification, along with rule set as shown in Table 1, the authors find out that the three-period shows the acreage as follows: 52.04 sq.km. in July, 57.07 sq.km. in mid-October and 50.82 sq.km. at the end of October. With the rechecking from the data of LDD in 2010, by accuracy assessment of the results from pixel-based classification, the outcomes are as follows: overall accuracy 88 % and overall kappa 0.7701 on the harvesting period, overall accuracy 88% and overall kappa 0.7602 on the tillering period, and overall accuracy 87% and overall kappa 0.7443 on the seeding period. It is noted that the growth period has a uniform format coverage. This study indicated that the LANDSAT 5 satellite image and knowledge of agriculture are essential for Rule-based classification in classifying the economic plantation accurately

Table 1: Rule Set

Period	Rules
Seeding Period	NDWI ≥ 0 , NDVI ≤ 0.3
Tillering Period	NDVI ≥ 0.2 , Mean B3 ≤ 20
Harvesting Period	NDWI ≥ 0.2 ,Mean B5 ≤ 60

Table 2: Accuracy assessment results from pixel-based classification

LANDSAT -5 DATA	Pixel – based classification							
	Producer's accuracy		User's accuracy		Kappa statistics		Overall accuracy	Overall kappa
	Rice	Non Rice	Rice	Non Rice	Rice	Non Rice		
27 Jul 2011	81%	92%	83%	92%	0.7481	0.7405	87%	0.7443
15 Oct 2011	79%	94%	88%	90%	0.8207	0.7080	88%	0.7602
31 Oct 2011	84%	92%	83%	93%	0.7599	0.7807	88%	0.7701

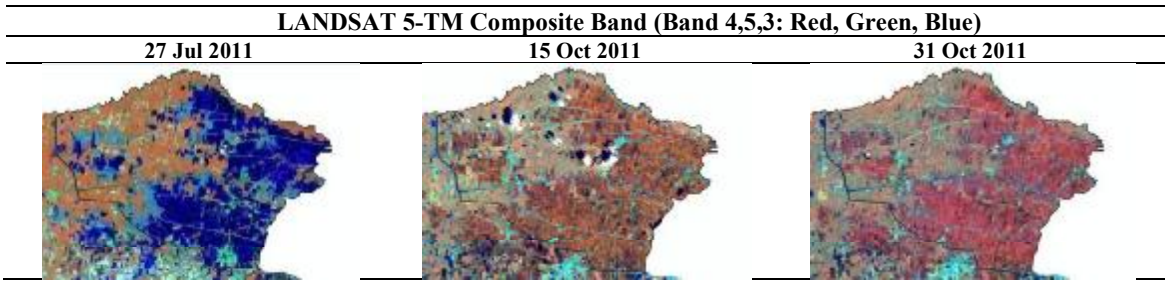

Figure 3 False Color Composite Band LANDSAT 5-TM (แบนด์ 4,5,3: Red, Green, Blue)

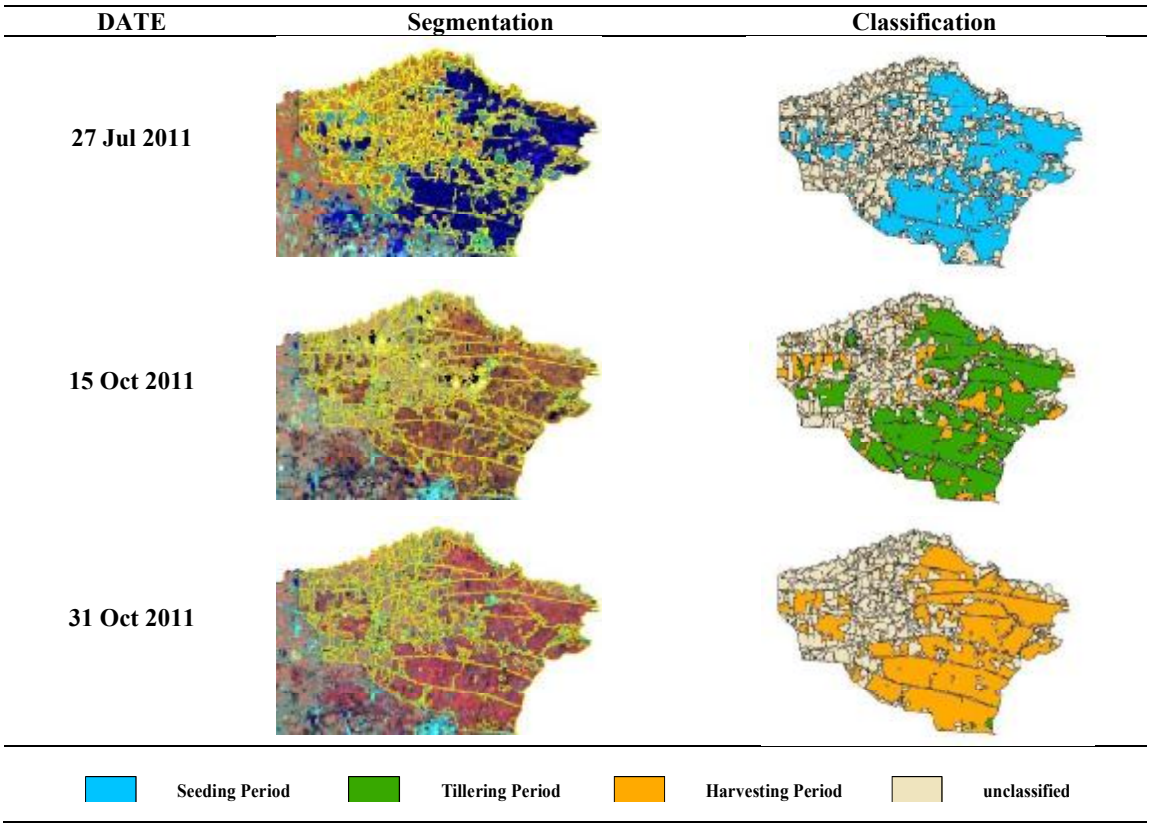

Figure 4 : Segmentation and classification

CONCLUSIONS &RECOMMENDATION

The authors recommend that this rule set from the study area may be applied in various field. However, there might need some adjustment in the rule set, in order to consort with the specific factors in the study field. Furthermore, it is necessary to choose the appropriate data, since each plantation period is not in the same time frame. Choosing a field without any crop leads to a useless outcome. The authors also recommend to weigh the factors not only on water and geographic condition but also on the climate as well. In conclusion, this study touches upon the primary classification of irrigated rice of the designated area but does not focus on the species classification.

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