CHAPTER III
METHODOLOGY

3.1 Materials

The hardware and software, used in the study are as the following:

3.1.1 Hardware.

1) Computer.

2) Geographic positioning instrument with satellite, GPS (Global Positioning System).

3) Digital camera.

3.1.2 Software

1) Program is to process Satellite data, Erdas Imagine.

2) Program is to use Geo – Informatics system, ArcGIS.

3) Program is to input GPS data to geographic positioning system named DNR Garmin.

3.1.3 Data sources, used in the study.

1) Secondary data

These data, spatial data and Attribute data, come from studying, collecting, and searching from related organizations, and are edited to be accurate before using in analysis. Fundamental data are shown in Table 3-1.

Table 3-1 Fundamental Data

Vector Data				
Data's Name	Type	Scale	Year	Source
land use	Polygon	1:50,000	2001, 2007	Land Development Department
Raster Data				
Data's Name	System		Year	Source
Photographs of Satellite, Thaichote	Pan chromatic Multispectral		2012	GISTDA*
Aerial photograph, (Ortho Photo)	Scale 1 : 4,000		2003	Land Development Department
Geographic Map, (Digital map)	Scale 1 : 50,000		2000	Royal Thai Survey Department

* GISTDA represents Geo – Informatics and Space Technology Development Agency (Public Organization).

2) Primary Data

These data come from interpreting aerial photographs in 2003, and analyzing satellite photographs in 2012 by examining with a computer, and verifying on field.

3.2 The procedure of the research.

The process of this study was separated in to 3 step including; land use classification, abandoned areas pattern classification and estimate the potentiality of the abandoned areas development in according with environmental management as diagram's shown in Figure 3-1.

3.2.1 Land use classification

Classified of land use pattern This study used satellite image Thaichote in years 2012 representing the land use pattern of Phuttamonthon district Nakhon Pathom province was classified using visual interpretation and computer automated

interpretation (semi-automatics classification) also used data on land use of the land development and topographic maps department of defense in scale 1:50,000 scale base and application of geospatial applications for land-use pattern classification level 3 by the of Land Development Department. The procedures were as follow:

3.2.1.1 Pre – processing.

To rectify the radioactive error, Radiometric Correction. It is conversion from the number of image luminance (DN) to the number of radiation, Spectral Radiance, the number of wavelength reflection of real data, Exo – Atmospheric Spectral Reflectance. To rectify wave of photograph of satellite, THAICHOTE, is calculated by using equation below (Naruemon, 2012)

$$L^{i}_{\lambda_{Thaichote}} = \frac{DN^{i}}{G^{i}} \qquad \text{Equation 3-1}$$

These symbols represent the meanings below.

$L^{i}_{\lambda_{Thaichote}}$ is the Spectral Radiance of sensor, THAICHOTE .for brand *i* (W m^{-2} sr^{-1} μm^{-1})

DN^{i} is the Digital Number for brand *i*

G^{i} is the gain of THAICHOTE for brand *i* (W m^{-2} sr^{-1} μm^{-1})

To rectify geometrical satellite data, Geometric Correction, by referring to co – ordinate system named WGS 1984, World Geometric System 1984, and mapping data in scale 1:50,000 correct in geometry. To specify Ground Control Points (GCPs) that spreads in the studying areas by using model, Second – Order Linear Polynomial Equation, and to rearrange image data is to valuate from the nearest pixel, The Nearest Neighbor Interpolation, the average of the error from each GCPs, Root Mean Square Error, RMSE, is between 0.25 and 0.50 pixels, the accepted level.

To emphasize image, Image Enhancement, causes the grey contrast inside image, Contrast Manipulation, by Histogram Equalization Stretch that is to spread original spectral reflectance to data frequency. If group have high frequent data, spectral reflectance of data in this group are spread more than lower frequent data in another group. Because of spreading spectral reflectance, satellite photograph is clear, and easy for translation in meaning.

3.2.1.2 Nomenclature

Nomenclature was determination of image classification frame. The nomenclature of this study was reference from land use classification system of Land Development Department in 1999.

3.2.1.3 Image Classification

It is to bring satellite image, passing processes of rectification, to interpreting translation of using land. The first step of this classification is to utilize unsupervised classification by ISODATA clustering algorithm, specifying the number of groups of data types (cluster), by types of using main land in the studying areas. The next step is to bring classified results to set into a new group by visual classification, Visual Interpretation), arranging data before classification.

3.2.1.4 Post Classification

Post classification was the last step for image classification. The land use classification result was done by image filtering to eliminate small area that were the misinterpreted areas by computer in order to make to be more data completed.

3.2.1.5 Classification Accuracy

Classification accuracy was calculated by confusion matrix accuracy method. That was to compare the classification result with the ground truth survey. Number of check point was calculated by binomial probability theory (Equation 3-1) (Clark University, 2003) Then accuracy correcting was not less than 80%.

$$N = \frac{Z^2 pq}{E^2}$$ Equation 3-3

These symbols represent the meaning below.

N is the number of examined points for total referring to image.

Z is the statistic standard (Z-Score) of the test at level of confidence, 95, and percent of two – side test (Two-Side Confidence Level) is 1.96.

p is the expected number of accurate level of classification.

q is 1-p

E is the accepted error, Allowable Error, calculated by Standard Deviation of data from Arithmetic Mean (Songgot, 2005).

3.2.1.5 Final Mapping

Corrective action boundary abandoned the deviation from the actual area (Polygon Editing) and the final mapping by checking the results of the survey in the field.

3.2.2 Abandoned areas pattern classification

3.2.2.1 Pre – processing

Thaichote satellite was used to classify for abandoned areas and the quality was approved by Histogram Analysis. They were prepared by radiometric, atmospheric, and geometric correction for strip or noise reducing and geometric position acquisition. Normally, radiometric and atmosphere correction were already processed by source of image (GISTDA). In the geometric correction of the study area, the co-register by image to image method was utilized. Map projection was Universal Transverse Mercator (UTM) zone 47; Acceptable root mean square error was not over 1.0 pixel (2 meters in real distance). Then, the study area was subset from the mosaic image.

3.2.2.2 Abandoned areas nomenclature identification

Types of data are free spaces in front of buildings, abandoned villages and industries, abandoned fields and farms, natural grasslands, scrubs or shrubs, water logged lowlands whole year, abandoned aquatic creature breeding sites and mines (modified by Land Development Department and Department of Public Works and Town & Country Planning, 2012).

In determining the form abandoned areas. Conduct land-use information obtained from the classification of semi-automatic and the data of the Department of Development and the Department of Public Works and Planning. Give information of all 5 types of areas abandoned buildings, abandoned paddy field, rangeland, marsh and swamp and open space or bare soil and land use include urban areas and building areas, agricultural areas, water and roads (adapted from the Department of Land Development , 2009 and the Department of Public Works and Town Planning , 2012) to. User-defined data types abandoned areas in Phuttamonthon district Nakhon Pathom province. In object-oriented classification using hierarchical properties to help identify the object. The details are as follows:

3.2.2.3 Abandoned areas classification (Object based classification)

1) Multi scale segmentation

In process of constructing object, to get image object has to specify 3 parameters, the number of scales, the number of colors or shapes, and the number of compaction or flatness. In this study classifies abandoned areas from other land utility. Therefore, only abandoned area group is examined. Because of high quality of satellite data, people can see types of land covers clearly, such as streets and water routes of community areas. To experiment by different variables indicates that same objects are divided into a same group, and the most appropriate scale is 10, the possibility of colors is 0.7, the possibility of cohesion and smoothness is 0.5.

2) Select training areas

The sampling area selection, training area, and the survey on field, Ground Survey. To survey on field and collect the data of the sampling areas in Phuttamonthon district, Nakorn Pathom province are to verify data from the study, and translate for interpreting the studying area data from satellite photographs and aerial photographs. To collect the sampling area data covers types of total land utility and to survey on field is to bring satellite data connecting to geographic positioning system (GPS), helping in localizing and navigating by connecting via program named DNR Garmin in real time and program named ArcMap. To show real area features and satellite photographs are to calculate the number of sampling areas at least 30 points per one sampling group for increasing reliable statistics of analysis.

3) Statistical analysis of training areas

When the extent of the area of each land use type. Examples of the wavelength used for processing. Samples from each of the waves are the statistics that can be analyzed statistically. To assess whether the sample selected by the various waves. Are reliable and represent good or not. The statistics used in this study include: - mean, standard deviation, brightness, NDVI, NDWI, BI, Texture (homogeneity, entropy).

4) Setting Condition for Classification

This specification is to select index for using in the study that are vegetation index (NDVI), water index (NDWI) and brightness index (BI). These

indexes are used to study relations in logistic regression equation that is Binary Logistic Regression, a correlative model of each index. Binary Logistic Regression is used to classify types of abandoned areas by specifying independent variables for types of abandoned areas, and dependent variables for vegetation index, soil index and water index. These variables are analyzed and created to be logistic functional equations of classifying each type of abandoned areas, and models of these equations (Model Maker) are written by satellite photograph processing software. The details of the image converting process are shown below.

Vegetation Index (Normalize Difference Vegetation Index: NDVI) It helps classification correct because this index is an indicator for areas covering with plants. It is calculated by an equation below.

$$NDVI = (NIR - RED) / (NIR + RED) \qquad \text{Equation 3-4}$$

These symbols represent the meanings below.

RED = wavelengths people see in red. (0.62-0.69 μm)

NIR = Near – Infrared wavelengths. (0.77-0.90 μm)

Brightness Index: BI

$$BI = \sqrt{\frac{BLUE^2+GREEN^2+RED^2}{3}} \qquad \text{Equation 3-5}$$

These symbols represent the meanings below.

BLUE = wavelengths people see in blue. (0.45 - 0.52 μm)

GREEN = wavelengths people see in green. (0.53-0.60 μm)

RED = wavelengths people see in red. (0.62-0.69 μm)

Normalize Deference Water Index: NDWI. It is calculated by an equation below.

$$WI = \frac{GREEN - NIR}{GREEN + NIR} \qquad \text{Equation 3-6}$$

These symbols represent the meanings below.

GREEN = wavelengths people see in green. (0.53-0.60 μm)

NIR = Near – Infrared wavelengths. (0.77 –0.90 μm)

(Source: Geo – Informatics and Space Technology Development Agency (Public Organization), 2005)

5) Classification

Image object classification is the processing of image objects from building objects for dividing groups of total image objects in the studying areas with correlated features of statistics, shapes of objects, resolution, data describing correlated specific features in each group and the differences from other groups by using program named eCogntion Developer having main commands that are Algorithm Classification and Algorithm Assign Class.

Classification: It is a command for image object classification that specifies feathers of data layers by conditional specifying methods, Threshold Setting. Image object classification by using conditions, image objects are in accordance with the conditions, and these image objects are in same group. If image objects are beside the conditions, they are in another group. The conditions are used that are ID, wave reflection of land utilization in different types, vegetation index (NDVI), and the methods using samples for classifying in the nearest position by selecting sampling areas of land utility for being samples in image object classification, and selected samples are statistic data that specify properties of sampling area data in each type of land utility, such as the number of image object reflection, the number of NDVI. The criterion of selected statistical data is to use histogram.

Merge Class: It is a command for combining same feathers of image objects, divided by order classification that is to combine image objects with the specific conditions. Therefore, Algorithm Assign Class is to combine data types from Algorithm Classification.

3.2.2.4 Classification Accuracy

Classification accuracy was calculated by confusion matrix accuracy method. That was to compare the classification result with the ground truth survey. Number of check point was calculated by binomial probability theory

(Equation 3-3) (Clark University, 2003) Then accuracy correcting was not less than 80%.

3.2.2.5 Final Mapping

Corrective action boundary abandoned the deviation from the actual area (Polygon Editing) and the final mapping by checking the results of the survey in the field.

3.3 To estimate the potentiality of the abandoned areas development in according with environmental management.

3.3.1 Estimate the potentiality of the abandoned areas development in according with environmental management.

Education and related basic data, including physical, economic, social and demographic study conducted by collecting secondary data. Of the research documents in any form of media types. In the operation of various agencies and the private sector and local communities. Which is in the form of spatial data (spatial data) descriptive information (attribute data).

3.3.2 Preliminary development plans abandoned areas and management abandoned areas.

Ecosystem transformation is the short and long terms that are called the dynamics of ecosystem including the ecosystem evolution affecting on the dynamics and the evolution of landscape. Dynamic patterns and evolution are the results of factors in ecosystem or landscape, or happening interactions and processes, such as the shape transformation of town, the distributing patterns, the transformation of the quantity and density, and the transformation of population and societies of living organisms, plants and others.

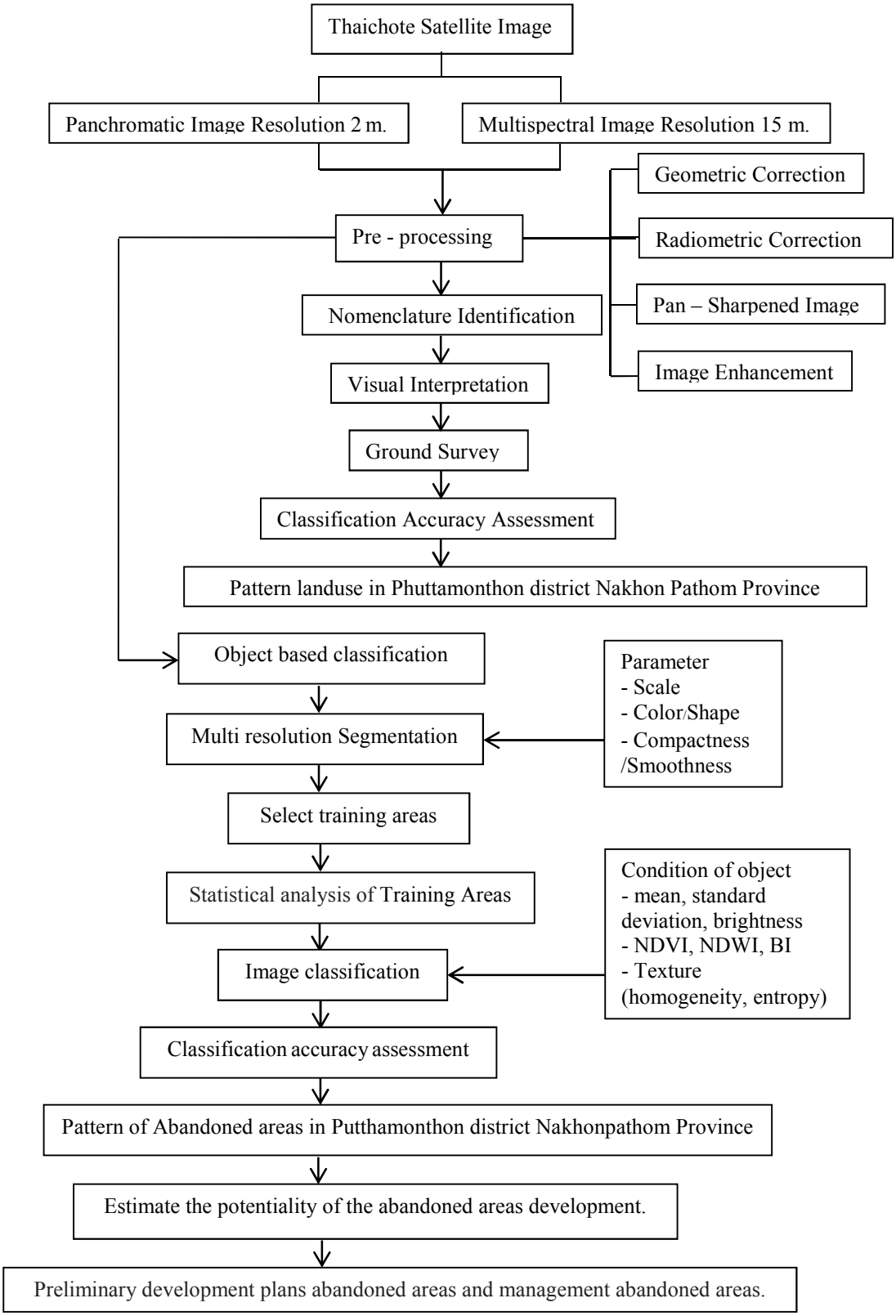

Figure 3-1 Flow diagram of abandoned areas classification