Taseko Prosperity Gold-Copper Project

Appendix 5-6-I

Appendix 5-6-I Satellite Imagery-based Regional Vegetation Classification Methods

I.1 Introduction

Satellite image classifications are a cost-effective method of mapping large areas. The vegetation mapping of the regional assessment area (RAA) of the Taseko Prosperity Mine project was developed using a supervised classification of a Landsat TM image. The classification identified 31 biotic and abiotic classes covering an area of 14,042 km².

I.2 Image Details

The Landsat TM satellite image (path 48 row 24) used to develop the vegetation classification was acquired on July 27, 2005. Patches of cumulus clouds are present throughout the image and within the RAA. It is not possible to map the vegetation under the cloud or the shadow of the cloud. Therefore cloud and shadow classes have been included in the classification to identify these areas.

I.3 Classification

A supervised classification was conducted using PCI Geomatica version 10.0.3 software. This type of classification relies on the expertise of the image interpreter to delineate and develop training sites for each class defined within the classification. Figure I–1 summarizes the steps involved in the classification.

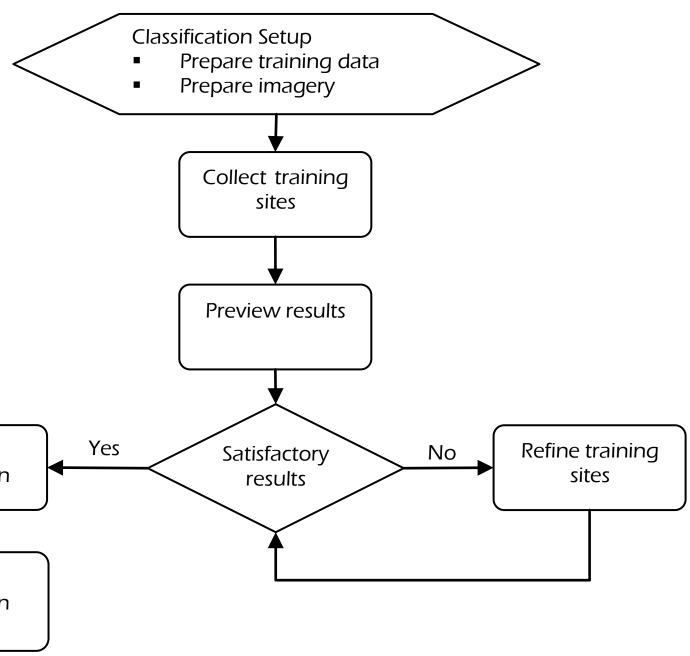

Figure I–1 Supervised Classification Process

The imagery inputs into the classification were the six 30-m, multispectral bands, of the Landsat TM sensor listed in Table I–1. A 1:250,000 scale digital elevation model (DEM) was also utilized to help in the delineation of the alpine classes. The individual 1:250,000 scale mapsheets (093A, 093B, 093C, 092N, 092O, 092P and 092J) that cover the RAA were downloaded from Geobase® and imported into the PCI format.

Table I–1 Landsat TM bands

Band	Wavelength
1	0.45-0.52 (blue-green)
2	0.52-0.60 (green)
3	0.63-0.69 (red)
4	0.76-0.90 (near-infrared)
5	1.55-1.75 (mid-infrared)
7	2.08-2.35 (min-infrared)

The data used to compile the training areas have come from multiple sources. The RAA vegetation classes were trained using the vegetation resource inventory (VRI) dataset collected for the local assessment area (LAA). The abiotic classes were trained using image interpretation which can be identified in the imagery with high confidence by the interpreter. The remaining classes were incorporated into the classification in the post-classification steps using other GIS data as masks. The mask information came from Terrain Resource Inventory Management (TRIM), Baseline Thematic Mapping (BTM) and the project disturbances datasets already gathered for the project. Table I–2 summarizes the training data sources for each of the vegetation classes.

Table I–2 RAA Classification Classes and Training Data Sources or Masking Sources

RAA Vegetation Class	Training Data Source	Source Definition/Description
Alpine	VRI	NPD_Description = “Alpine”
Alpine forest	VRI	NPD_Description = “Alpine Forest”
Clearing	VRI	NPD_Description = “Clearing”
Coniferous	VRI	Species 1 or 2 that are coniferous species or Coniferous species 1 that are > 50%. Other than Pine
Coniferous – pine	VRI	Species 1 = Pine and >50%
Deciduous	VRI	Species 1 or 2 that are deciduous species or deciduous species 1 that are > 50%
Exposed ground	VRI	NPD_Description = “Gravel bar” or “Gravel pit”
Grassland	VRI	NPD_Description = “Meadow” or “Open range”
Mixed forest	VRI	Both deciduous and coniferous forests that are no more than 70% or either type
Shrub	VRI	NPD_Description = “Non-productive brush”
Rock	VRI, Image interpretation	NPD_Description = “Rock”
Urban	BTM mask	NPD_Description = “Urban”
Wetland	VRI	NPD_Description = “Swamp”
Wetland – Treed	TRIM mask	Wetlands that are within the TRIM wetland polygons and also have tree characteristics from the image

RAA Vegetation Class	Training Data Source	Source Definition/Description
Wetland – Shrub	TRIM mask	Wetlands that are within the TRIM wetland polygons and also have shrub characteristics from the image
Wetland – Non-treed	TRIM mask	Wetlands that are within the TRIM wetland polygons and also have bare or water characteristics from the image
Agriculture	BTM mask	Areas defined as agriculture or agriculture mix from the baseline thematic mapping (BTM) provincial dataset
Badlands	VRI, Image interpretation	NPD_Description = “Clay bank”
Bare	Image interpretation	Areas of exposed ground that can be identified in the image
Transmission Line	TRIM mask	Transmission lines identified in the TRIM base mapping
Logging	Project disturbances mask	Cutblocks that were identified in the project disturbance layers
Logging – Regenerating	Project disturbances mask	Cutblocks that were identified in the project disturbance layers and have a shrub or young tree characteristics identified in the image
Burn	Project disturbances mask	Burns that were identified in the project disturbance layers
Burn – Regenerating	Project disturbances mask	Burns that were identified in the project disturbance layers and have a shrub or young tree characteristics identified in the image
Shallow Water	Image interpretation	
Water	Image interpretation	
Ice	Image interpretation	
Haze	Image interpretation	
Cloud	Image interpretation	
Shadow	Image interpretation	
No Data	Image interpretation	Areas outside the actual imagery and dropped pixel values

Once the training areas were developed a supervised classification was performed on the imagery. The maximum likelihood classifier, within PCI, was used to process the imagery into the defined classes. The results were then reviewed and the training sites were refined if the classification results were not satisfactory and the classification was re-run. This process was repeated until satisfactory results were obtained.

The post-classification processing consisted of incorporating the class masks listed in Table I–2. The mask polygons for agriculture, cutblocks (logging), burns, wetlands, urban and transmission lines were imported into PCI and added to the classification. A series of reclassifications were performed on the resulting dataset to identify and keep the valid classes within the masks and to incorporate the new classes into the classification. For example, exposed ground in an agricultural land use would be reclassified to the agriculture vegetation class based on the assumption that it was a fallow field. After the new classes were incorporated into the classification a sieve filter was performed to remove any speckles and to bring the minimum polygon size to 1 ha. The classification was then exported into an ESRI GRID format so that an accuracy assessment could be performed.

I.4 Accuracy Assessment

The accuracy assessment for this project contains two parts. The first assessment is the standard accuracy assessment in which the training sites of the classification were used to assess the results. The second assessment used the field data collected for the LAA, road corridor and the transmission line. These data were overlaid on the RAA classification and the classes compared.

The classification assessment uses the training data and determines the percentage of cells within each class that have been classified correctly or incorrectly. The average accuracy for the whole classification was 89% with shrub and wetlands having the lowest accuracy at 82 and 63% respectively.

The field data that were collected for the LAA, road corridor and transmission line were reclassified into the RAA vegetation classes and overlaid with the results of the classification. Due to the spatial accuracy between raster datasets and single point locations, the points were buffered by 100 m prior to the overlay analysis. The overall accuracy for this method was significantly lower than the first method at 57% for the following reasons: the number of samples per class is very low; and not all RAA classes were accounted for in the field data. To help resolve these issues the classes of both the classification and the field data were grouped into more general classes to obtain a higher sample size. The general classes are forest, grassland, shrub and wetland. The resulting accuracy using this method was 83%.