

Application of GIS and Remote Sensing For Researching Land and Surface Water Resources in the Basin Of Son La Hydropower Plant

Dam Xuan Van¹, Tran Van Dien¹, Tran Thi Pha¹, Van Huu Tap² & Pham Duc Anh¹

¹Thai Nguyen University of Agriculture and Forestry, Viet Nam

²Thai Nguyen University of Sciences, Viet Nam.

Abstract: Applying ENVI and ArcGIS software in processing and interpretation of Landsat TM image with 30m resolution of Son La hydropower basin which was taken in March 2014, in conjunction with collected data for mapping of vegetation. The obtain results showed that there are 4 land use types: rocky 48406.5 ha; vegetation 8870.4 ha; 550598.4 ha of bear land; 30892.5 ha of water surface. Map of vegetation of the Son La hydropower basin is an important document in watershed management, exploitation and efficient use of land and water in the basin of the Son La hydropower which contributes to protecting soil resources, reduce reservoir sedimentation and propose livelihoods solutions for local people in the region.

1. Introduction

The length of Son La hydropower reservoir basin (SHRB) is about 120 km, beginning at It Ong town, Muong La district, Son La province and ending at Muong Lay town, Dien Bien province. With the area of reservoir of approximately 225 km², the capacity of 9.25 billion m³, BSHR covers approximately 44,000 km² in three provinces of Son La, Dien Bien and Lai Chau [3]. A geological structures and tectonic of BSHR and it's surrounding are complex, fragmented, active fault and seism capacity.

Being in the basin of Da river, it crosses high and medium mountain areas. It's flow direction is parallel big mountains. The river-bed of Da is narrow and waterfalls. Some riversides are bored deeply into mountain. SHRB is generally a valley that was expanded with two slopes pitching deeply into the reservoir. Most mountain slopes are from 20⁰ to 30⁰. The length of mountain slopes are from 70 to 80 m. the length of less 70 m and more 80 m is limited [4].

A surface of mountain top and slopes was taken from eruption sedimentary rock group lead to erosion, washout processes. A phenomenon of upland cavitation or landslide and flow slip under the human impact usually occur on the surface of lower slopes. Therefore, "Application of GIS and Remote

sensing for for researching land and surface water resources in the basin of Son La hydropower plant" is necessary.

2. Materials and methods

2.1. Research Contents

- Researching application capacity of remote sensing and GIS to establish maps of vegetation and land resource of SHRB.
- Analysis and assessment of vegetation and soil resource. Putting forward protection solutions of land, vegetation in SHRB.

2.2. Methods

Remote sensing image (satellite image) interpretation by using ENVI 4.7 software to classify LANSAT 8 satellite image with resolution of 30 m at SHRB. Editing and establishing the maps by ArcGIS 10.2 software [1,2].

2.2.1. Image treatment method

Image treatment method was used is a process of image drawing, interpretation and treatment for the purpose:

- Drawing and delineating factors of state use of the land in the image.
- Checking drawing, delineating results of factors of state use of the land in the image.
- Completing and printing the maps.

2.2.2. Researching the scene

Process of mapping and land resources need to be conduct:

- Investigations, cross-check, supplement and revise the content on the basis of geographic based on raw maps.
- Investigating, examining and cross-check the results of the draw internal content factors of land

use status in the field and to revise and the missing content.

- Checking, revising drawing results.

Both methods of image treatment and the scene should be proceed in the same time in order to obtain the highest quality.

3. Results and discussion

3.1. Remote sensing image interpretation in ENVI software

3.1.1. Cut perfect finishing

For conducting this content, a image channel was chosen to display and cutting the image of SHRB (Figure 1). The result shows in figure 2.



Figure 1. Image channel results

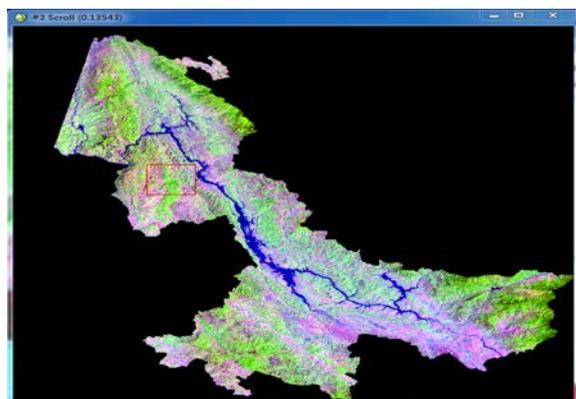


Figure 2. Cut Image

3.1.2. Classifying digital image

Classifying a digital image is the classification and arrangement of pixel on images to become different groups based on some general characteristics of values of gray, uniformity, density and image tone. Pixels were divided into classes automatically based on characteristics of uniformity of a spectrum value with using group gross technology by unsupervised classification on ENVI software [1]. This method is used in a case that we do not know objects appearing on the image, it also eliminates subjective errors of human.

ENVI software that provides two methods of unsupervised classify is Isodata and K-Means. Classifying by Isodata will measure the values of the first class that are distributed steadily in a data space. The nearest pixels are then grouped by using the shortest distance technology. It was classified by Isodata to receive cut images of SHRB (figure 3). After processing classification, the results was the map that displayed subjects by different colour, each subject was one class.

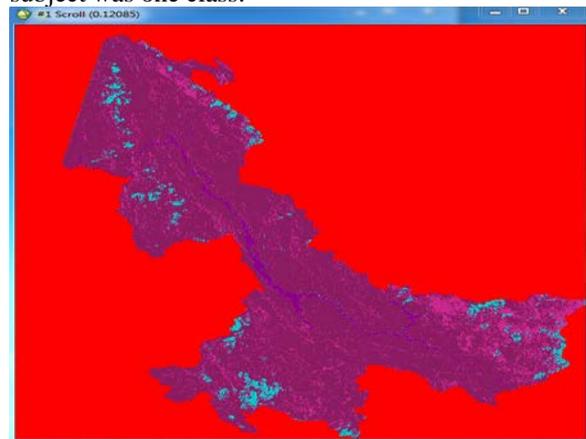


Figure 3. Classified map

3.1.3. Transferring the classified results into Vector form

After completing classification, result files was transferred into vector form to exchange and treating easily information and editing the map on different softwares. After that, vector files were transferred into shapefile to edit into the map by ArcGIS software (figure 4).

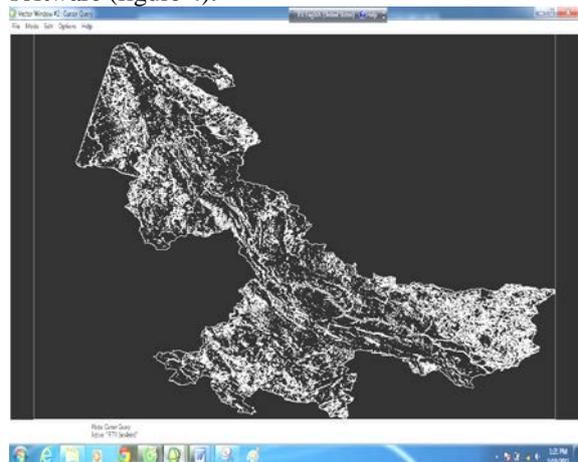


Figure 4. Classification of vector form

3.2. Editing the map of vegetation and land resource by ArcGIS software

3.2.1. Status classes

Digitizing the map was conducted by ArcGIS 10.2 with a high fidelity of classification (85%)

(figure 5) and attribute classification table of subjects (figure 6). From the results of editing map of subject classification, zone areas and classes were reckoned up, including: 48,406.5 ha of stone mountains, 8,870.4 ha of vegetations, 550,598.4 ha of unused land, 30,892.5 ha of surface water (figure 7).

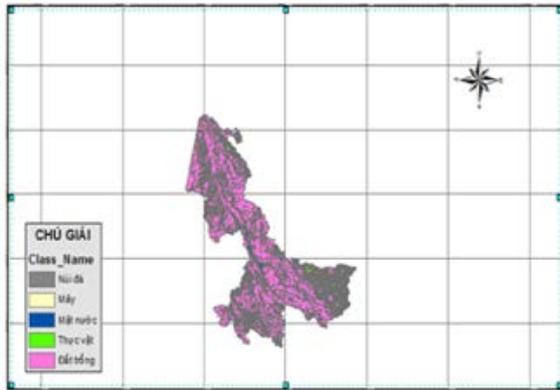


Figure 5. Vegetation map of SHR

Shape	Class_Name	Class_Id	Parts	Length	Area
Polygon	Class 1	1	1	1194420	12697508700
Polygon	Class 1	1	1	282720	1233822600
Polygon	Class 29	2	2	2640	130500
Polygon	Class 29	2	1	960	29700
Polygon	Class 29	2	1	1980	71100
Polygon	Class 29	2	1	660	12600
Polygon	Class 29	2	1	120	900
Polygon	Class 29	2	1	420	5400
Polygon	Class 29	2	1	1140	40500

Figure 6. Attribute map table

Class_Name	Cnt_Class	Min_dien_t	Max_dien_t	Ave_dien_t	Sum_dien_t	SD_dien_t	Var_dien_t
Núi đá	2066	0	9900	2343.0058	4840650	2554.5511	6525731.4450
Mây	1	0	0	0.0000	0	0.0000	0.0000
Thực vật	302	0	9900	2937.2185	887040	2529.2837	6397275.9587
Đất trống	19402	0	9900	2837.8435	55059840	2553.3061	6519371.9588
Mặt nước	1095	0	9900	2821.2329	3089250	2581.5940	6664627.6377

Figure 7. Areas of subjects

3.3. Analysis of advantages and disadvantages as well as proposing solutions for land and surface water resources in SHR

3.3.1. Advantages

- Land and water resources are available in SHR for developing agriculture, forestry and pisciculture.

- Most land resource in SHR includes a barren land that need to be considered to develop forest to soil improvement and planting annually...

- Water resource of Da river follows its basin and containing small river branches. It is the advantage for aquaculture, especially cages.

3.3.2. Disadvantages

- Shifting cultivation of wandering hilltribes had been fairly quickly in past, so the land that is covered by plant is not much. Most of land are not covered leading to effects on environment and causing flash floods, landslides land, sedimentation of reservoirs.

- Areas around the reservoir, upstream affected much by water up and down by SHR.

3.3.3. Proposing solutions for land and surface water resources in SHR

- Policies should be developed reforestation and forest protection in the barren land in SHR.

- Need to research to plant Melaleuca trees to protect the land and the ecological environment and livelihood for people in the reservoirs.

- Utilizin the water resource for development cage farming to contribute to livelihoods for people.

- Management should be taken and stop the use of explosives, electrical pulses, poisons and illegal fishing gear to catch at the Son La hydropower reservoir.

- The area of limestone is quite large and clay limestone with steep cliffs and it is considered to have many beautiful landscapes for ecological tourism development.

4. Conclusions

Results of GIS and remote sensing applications to study land resources, surface water in SHR based on Landsat TM image interpretation with 30m resolution taken in March 2014 and combination with collected document to establish the map of the vegetation including 4 types of land uses: rock mountain of 48,406.5 ha; vegetation of 8,870.4 ha; unused land of 550,598.4 ha; water surface of 30,892.5 ha. The map for the assessment of land resource, surface water in SHR is important documents for watershed management, exploitation and efficient use of land and surface water that contribute to the protection of environment, reducing reservoir sedimentation and create livelihoods for people in the region.

5. References

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