

# Space Education And Awareness Activities In Nepal

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## **Abstract**

*The advancement in space technology has presented the modern world with many opportunities for collection, analysis and dissemination of information. The information of space technology could be used on various activities of development projects for economic growth and sustainable development of any country. In Nepal, the use and application of space technology has been brought into practice since 1970's. Government of Nepal has given the priority for the application of space technology to fulfill the national objective of poverty reduction and sustainable development of the country.*

*This paper describes the various organizations involved on the application of space technology together with the space education and awareness activities in Nepal. Finally, it describes about the constraints and future prospectus of space technology application in Nepal.*

## **1. Country background**

Nepal is a small mountainous land locked country surrounded by China in North and India in South, East and West. Geographically, it is located between 26 degree N to 31 degree N latitude and 80 degree E to 88 degree E longitude. The elevation ranges almost from 60m to 8848m, the highest peak of the world, Mount Everest (Mount Sagarmatha). The length in the east-west direction is about 885 km. and the width in the north-south direction varies between 145 km to 245 km. The area of the country is 147

181 sq. km and a population of about 23.5 million. Depending upon the elevation, the country is divided into five physiographic regions namely: Terai (Plain area) 60-300 m, Siwalik Hills 200-1500m, Middle Mountains 800-2400m, High Mountains 2200- 2400m, and Himalayas 5000- above. Due to a wide variation in the topographical characteristics different climatic variations are available in Nepal. Accordingly, Nepal offers tropical, sub tropical, temperate, and alpine and sub arctic types of weather depending on the elevation. The mean temperature is about 15<sup>0</sup> celcius; however summer temperature reach over 45<sup>0</sup> celcius in some places in the Terai. About 80 % of the precipitation occurs during the monsoon season from June until September. It has a rich human culture and natural biodiversity with more than 61 ethnic groups and almost 70 spoken languages.

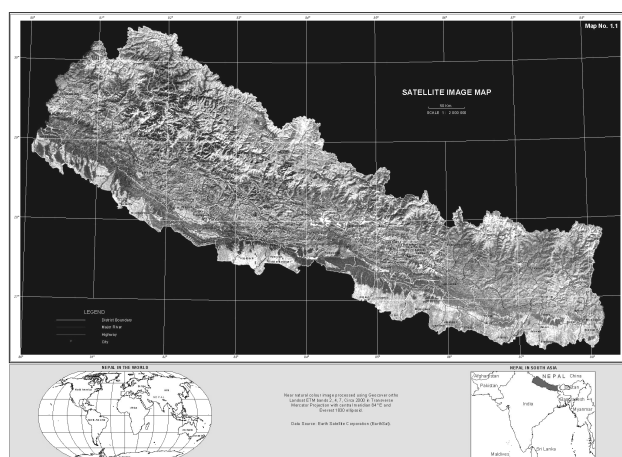


Fig. 1: Location of Nepal

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## 2. Introduction

The application of space technology has been brought into practice since 1970's where satellite imagery was used for the land use mapping purposes. The application of space technology has always been the concern of Nepalese Government to fulfill the national objective of poverty reduction and sustainable development. Nowadays, the application of space technology is in practice in Nepal to solve various issues like environmental degradation, resources management, population growth, urbanizations etc. is in practice in Nepal. Government of Nepal has given emphasis to introduce space technology in its Ninth and Tenth Five Year Plan for poverty mapping and preparation of land use maps. Several organizations are involved in the application of space technology to achieve their organizational goal. Governmental organizations, non-governmental organizations (NGO), International Non-Governmental Organization (INGO's), academia, private sectors and local authorities are the main stakeholders. In Nepal, there are basically three types of products (Global Positioning System (GPS) Data, Remote Sensing Imagery and Aerial Photographs) used through space technology application. Global Positioning System (GPS) is used for establishment of ground control points; Remote Sensing (RS) technology is used for updating as well as classification of spatial datasets, change detection, weather forecast and disaster management; Aerial photographs are used for the preparation topographical base maps and orthophoto production.

## 3. Institutional framework

There are various organizations in Nepal involved on the use and application of space technology. They can be categorized into four main groups.

### (a) Governmental Organizations

1. Ministry of Science and Technology

2. Ministry of Land Reform and Management
3. Ministry of Agriculture/ Department of Agriculture
4. Survey Department
5. Department of Forest
6. Department of Urban Development and Building Construction
7. Department of Mines and Geology
8. Department of Hydrology and Meteorology
9. Department of Water Induced and Disaster Prevention
10. Land Management Training Centre

### (b) Academia

1. Central Department of Geography (Tribhuwan University)
2. Institute of Engineering (Tribhuwan University)
3. South Asian Institute of Technology (Purbanchal University)
4. School of Environmental Management and Sustainable Development (SchEMS), (Pokhara University)
5. Himalayan College of Geomatic Engineering and Land Resource Management (Purbanchal University)
6. Kathmandu University
7. Department of Geography/Geology Trichandra Campus, (Tribhuwan University)

### (c) Private Sectors

1. Auto Carto Consult (P.) Ltd.
2. Genesis Consults (P.) Ltd.
3. World Distribution Nepal
4. Others.....

### (d) International Organizations

1. United National Development Program (UNDP)
2. FAO
3. WFP

4. UNEP (United Nations Environment Program)
5. International Center for Integrated Mountain Development (ICIMOD)
6. Others.....

A brief description of the main organizations involved on the use and application of space technology has given below.

### **3.1 Survey Department**

Survey Department is the National Mapping Agency and one of the important departments, which is using space technology in different sectors. Satellite imagery was used for the first time for land use mapping project during 1970's. It has been using Global Positioning System (GPS) for last 12 years for strengthening National Geodetic Control Network and International Boundary Survey. It also has been using Satellite Data (IRS 1c/1d, IKONOS etc.) for updating topographical base maps. The digital Orthophoto maps are also prepared and made available for the development projects.

### **3.2 Department of Forest**

Department of Forest is pioneer in Nepal in the application of satellite imagery for forest mapping. Remote Sensing Centre was established in Nepal under this department in collaboration with USAID. It has been using satellite data for forest classification, land use, land cover classification and change detection. This Department is using IRS, Landsat and SPOT images for above mentioned applications.

### **3.3 Department of Urban Development and Building Construction**

Department of Urban Development and Building Construction has been using the space technology to produce the base maps of municipalities. This department has been

using high resolutions satellite imagery such as IKONOS, Quick bird, IRS 1c/1d etc.

### **3.4 Department of Mines and Geology**

Department of Mines and Geology is using satellite data (Landsat, SPOT, IRS etc.) for geological mapping, classification of rocks, earth quake prediction, damage detection, and mineral exploration. This department is also using GPS for field work.

### **3.5 Department of Hydrology and Meteorology**

Department of Hydrology and Meteorology is using satellite data (Landsat and IRS) for weather forecasting. The weather forecast information is made available to the users which are based on the data down loaded through web after manual interpretation.

### **3.6 Land Management Training Centre**

Land Management Training Centre is under the Ministry of Land Reform and Management and actively involving for human resource development in space technology and land management field. It conducts the training of different level such as Basic, Junior and Senior level to produce skilled manpower in surveying, mapping and space technology field. It also conducts short-term training programme and refresher courses in the application of space technology. This training centre is also using GPS, aerial photographs, Orthophoto and satellite data for its training purposes.

### **3.7 International Center for Integrated Mountain Development (ICIMOD)**

One of the main objectives of ICIMOD is to establish and promotes a decentralized network of partner institutions

in the Hindu –Kush Himalayan Region. This organization is organizing different types of training, workshops and awareness program in the space technology application sector. It also provides guidelines to enhance capacity of national institutions to use GIS and RS technology for sustainable mountain development.

### **3.8 Central Department of Geography**

Central Department of Geography under Tribhuvan University conducts various training programme in the field of space technology. It conducts RS/GPS training programme and teach RS/GIS for Master's Degree (Geography) students. It also conducts research activities to provide scientific contribution in various space technology application fields. It uses satellite images (Landsat, Spot, IRS etc.), aerial photographs/Orthophoto, GPS data for teaching and research works.

### **3.9 Institute of Engineering**

This is the oldest engineering college in Nepal in the field of engineering and conducts academic programme in Bachelor's and Master's Degree level. It uses satellite imagery (Land sat, Corona and NOAA etc) for teaching and research works. It also conducts short training programme in RS/GPS.

### **3.10 South Asian Institute of Technology**

This institution provides technical education and training programme both for national and international level in the urban mapping, environmental mapping and resources mapping, development and planning fields using RS/GIS. This institute also provides consultancy services in the field of space technology application. The main products used by this institute are satellite image, aerial photographs, and Lidar data etc.

### **3.11 Himalayan College of Geomatic Engineering and Land Resource Management**

This college provides Bachelor's Degree academic education in the field of Geomatic Engineering and Land Resource Management in Nepal. It also conducts various short – term training programme as well as research works in space technology sector (RS and GPS).

### **3.12 School of Environmental Management and Sustainable Development (SchEMS)**

SchEMS under Pokhara University conducts B.Sc. Degree and M.Sc. Degree course in Environmental Management (EM). GIS and RS are the core modules for graduate courses in EM students under Pokhara University. It conducts various research works and short-training programme using GIS/RS tools. It also organizes international training program in application of RS/GIS in environmental management sectors.

### **3.13 Kathmandu University**

Kathmandu University is using RS/GIS tools for Engineering students as well as Environmental Science students. It also uses the space technology products like aerial photographs, orthophoto, satellite imagery and GPS data for teaching as well as research works.

## **4. Space education and awareness activities**

Although some work is being done in the field of space technology in Nepal, yet much remain to be done. There are various themes and one of the most important themes is space education and awareness activities. A study has been done in different institutions involving for the use and application of space technology in Nepal. The result has tabulated below.

<b>INSTITUTIONS</b>	<b>EDUCATION (Training/Academic Course)</b>	<b>AWARENESS</b>
<b>A. Government Organizations</b>		
1. Ministry of Science and Technology		a. Workshops b. Discussion Program
2. Survey Department	a. Short term training in RS/GIS b. Setup remote sensing lab	a. Organized ACRS 2002 conference b. Organized Seminar on Space Technology Application in 2005
3. Land Management Training Center	a. Conduct Basic, Junior and Senior level training in surveying and mapping b. Short term training and refresher course in RS/GIS	a. Workshops
4. Department of Forest	a. Short term training for staffs in RS/GIS	a. Workshops
<b>B. Academia</b>		
1. Central Department of Geography	a. Conduct short term and advanced training in RS/GIS b. Teach GIS/RS/Surveying for M.A. level students (Geography) c. Research works	a. Pamphleting b. Curriculum development
2. Institute of Engineering (Tribhuvan University)	a. Conduct short term training in RS/GIS b. Tech GIS/RS/Surveying for Diploma Course, B.E., Master's Degree in Water Resources/Environment	a. Workshop
3. South Asian Institute of Technology (Purbanchal University)	a. Application of RS/GIS in planning, management and development b. School level RS/GIS	a. Workshops b. Seminars c. Talk Programs
4. School of Environmental Management and Sustainable Development (SchEMS), (Pokhara University)	a. Teach GIS/RS/Surveying for B.Sc. and M.Sc. Degree in Environmental Management b. Short term and international training programme in GIS/RS	a. Workshops b. Seminars
5. Himalayan College of Geomatic Engineering and Land Resource Management (Purbanchal University)	a. Teach GIS/RS/Surveying for B.E. level students b. Short term and refresher course in RS/GIS c. Research works	a. Workshops b. Seminars
6. Kathmandu University	a. Teach GIS/RS for Bachelor's and vMaster's level students in Civil Engineering and Environmental Science b. Research works	a. Workshops
<b>C. International Organizations</b>		
1. ICIMOD	a. Training on RS/GIS for Natural Resources Management, GLOF etc. b. Decision Support Systems (DSS) c. Research works	a. Workshops b. Discussion Program c. Seminars and Exhibition
<b>D. Private Sectors</b>		
	a. Short training programme in RS/GIS/GPS and digital Photogrammetry b. Hardware/Software development for space technology application	a Seminars and Exhibition b. Workshops

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## 5. Constraints

It is clear that, space technology is applied in several organizations in limited sectors. Some of other sectors, besides mentioned in the above table could be telecommunication, wildlife habitat mapping, watershed management, tectonic movement, natural disaster prevention, control and monitoring, cadastre and land management etc. Though the government has given priority in its policy document for the use and growth of GIS/RS, there are more opportunities and potential to apply space technology in proper way. The main constraints to harness the potential of this technology have listed below.

- Lack of availability of space image data and affordability
- Lack of networking and coordination among the users and producers of GIS/RS tools
- Lack of stakeholders participation for the use and application of RS/GIS tools
- Lack of awareness to work together in a common technical platform
- Lack of proper education and awareness in the field of space technology
- Lack of proper human resources and expertise
- Lack of financial support at different level such as data acquisition, data processing and data dissemination
- Lack of data sharing policies

## 6. Future prospectus

From the above description it is seen that the space technology application in Nepal is not in the matured condition. Institutions working on space technology and its application sectors need to change their working strategy and develop the system to accommodate the latest technology as far as possible. Some of the future prospectuses in space technology applications in Nepal are as follows.

### 6.1 Agriculture

Nepal is a country where most of the people are based on agriculture. The agricultural products are the main tools to enhance economic growth and sustainable development. Space technology could provide suitable tools

to various agricultural crops, yield forecasting and monitoring agricultural areas.

### 6.2 Education and Research

In the field of education space technology educate school children, university students and general public on the issues of environmental awareness and for their practical assignment through better illustrations. The products could be also used for various research works.

### 6.3 Poverty Reduction Programs

The national objective of government of Nepal is poverty reduction. Space based technology could help indirectly to reduce the poverty as it could be used as a better planning tool for various natural resources and land use.

### 6.4 Forestry

Application of space technology in forest sector could help in better inventory of forest resources, sustainable use of forest resources, reforestation activities and helping the management of community forest.

### 6.5 Tourism

It is also an important sector to earn foreign currency for our country. The use of space technology could improve the industry with better planning of tourism infrastructures, generation and dissemination of information such as by virtual reality, better quality maps, and better facilities for tourists etc.

### 6.6 Disaster Management

Space technology could help in various measures for prediction, mitigation and management of disasters such as earth quakes, avalanches, land slides, floods etc.

### 6.7 Biodiversity

Space technology also helps in better management of biodiversity through better mapping of resources and strategies for biodiversity conservation.

### 6.8 Transportation and Utilities

One of the important application sectors for space technology is transportation and utilities. There is a growing demand of space technology application in utilities like

telecommunication, water supply and electricity. The satellite imagery and RTK GPS data could be used for transportation as well as utilities sectors.

#### 6.9 Cadastre and Land Management

The space technology could be used in cadastre and land management sector. The Orthophoto and RTK GPS data could be used for cadastral information updating and LIS development in Nepal. It could be a quick tool for renovation of damaged land information due to conflicts during last decades in Nepal. Its application will help for effective service delivery and finally promotes for good governance in Nepal.

### 7. Conclusions

The application of Space technology is in practice for various themes in Nepal. Different organizations are using space technology products for service delivery and system development. It has realized that space technology could be an important tool to make strategy for national development activities. There are some constraints like lack of technical expertise and financial constraints, lack of networking and coordination among organizations, lack of data sharing policies etc. But also there are various future prospectus areas for the application and use of space technology. The education and awareness programme need to be enhanced and all stakeholders need to work together in a common technical platform. Survey Department should lead for the development of space technology in Nepal. The national and regional co-operation is also the most possible solution to get the optimal benefit from space technology application sector.