

# INSTITUTIONAL NETWORKING FOR A REGIONAL SDI IN THE HINDU-KUSH HIMALAYAS

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## ABSTRACT:

The International Centre for Integrated Mountain Development (ICIMOD) has been working towards developing a Regional Spatial Data Infrastructure (RSDI) in the Hindu Kush-Himalayan (HKH) region to attain the common goals of an accurate geo-information base to address the various issues related to sustaining mountain ecosystems. The present activities in this endeavour, challenges and the approaches for way forward are discussed in this paper. Climate change, water and poverty are the three strategic thrust areas of ICIMOD with its activities focusing on addressing the needs to investigate, to develop adaptation mechanisms and to prepare the communities and nations of the HKH to successfully manage the changes that are taking place. Many of these issues are of trans-boundary concern and an improved understanding of key components of these issues is necessary to effectively address them. Geographic information has been a common denominator for studies in many areas of concern. However, when it comes to basic data and information, the HKH region is still very poor. There have been initiatives at the global level for generating core geographic datasets which are required for multiple applications. Keeping in view that the global datasets lack the required details to define the mountain geography and ecosystems of the HKH and the national datasets are fragmented and poorly maintained, there is a strong need to develop datasets that are useful for regional applications. ICIMOD has been working on promoting regional cooperation through interdisciplinary and cross sectoral partnerships. In this respect, ICIMOD's approach towards the RSDI is to develop basic data layers at regional scale and a common framework for sharing data and knowledgebase. Partnerships and networking among the national and regional institutions and their capacity building have been the major strategies for the development of RSDI. The long term goal of having a RSDI is to develop networks of institutions linked by intra-regional institutional framework that provides mechanisms for sharing experience, technology transfer and coordination in development and use of fundamental datasets of the region.

## 1. INTRODUCTION

### 1.1 Background

The International Centre for Integrated Mountain Development (ICIMOD) has been working as the only regional centre for sustainable livelihoods of the mountain people and promoting economically and environmentally sound development of mountain ecosystems in the Hindu Kush-Himalaya (HKH) region which includes parts or whole of Afghanistan, Pakistan, India, Nepal, Bhutan, China, Bangladesh and Myanmar (figure 1).



Figure 1. The Hindu Kush-Himalaya (HKH) region

Population dynamics, economic growth and climate change are emerging as major issues concerning the livelihoods, social and environmental security of the mountain people in the HKH region. The natural resources are rapidly degrading due to pressures of population and economic activities. The impacts are further accelerated due to the effects of climate change. ICIMOD has identified climate change, water and poverty as the three strategic thrust areas to focus its activities to address the needs to investigate, to develop adaptation and coping mechanisms and to prepare the communities and nations of the HKH to successfully manage the changes that are taking place (ICIMOD, 2007). Many of these issues are of trans-boundary concern and an improved understanding of key components of these issues is necessary to effectively address them. Knowledge about the state of natural resources, economic status of the people and the effects of climate change are fundamental for efficiently developing, implementing and monitoring interventions to address these issues.

ICIMOD being a Knowledge, Learning and Enabling centre, knowledge generation and dissemination are among its core functions. Geographic Information is an important knowledge component and a common denominator for many of these areas of concern. Usefulness of Geographic Information technology for better assessment, analysis and understanding of various issues has been well realized. ICIMOD has been working in dissemination of Geographic Information and Earth Observation technologies through its Mountain Environment and Natural Resources Information System (MENRIS) division since the early 1990s with a major focus on capacity building

and networking of national institutions in the regional countries, and development of databases and applications in different thematic areas (Shrestha and Bajracharya, 2004). These initiatives have contributed as building blocks of a spatial data infrastructure (SDI). However, in the context of newly identified strategic thrusts with climate change as a major area of concern, there is a need for a more formal and concerted effort towards developing an SDI with special attention to mountain specificities of the HKH region.

### **1.2 Spatial Data Infrastructure (SDI)**

Geographic Information and Earth Observation Technologies together with Information Communication Technology (ICT) and decision support tools have greatly changed the ways in which the issues on livelihood, resource management and environmental conservation can be addressed. However, unavailability of basic geographic information, and difficulties in finding and using existing information lead to unnecessary and expensive costs in terms of project durations and recapturing of data. There is a clear need, at all scales, to be able to access, integrate and use spatial data from disparate sources in supporting decision making to fully benefit from the potentials offered by these technologies.

The concept of SDI has emerged to address this need which includes the collection of policies, organizational remits, data, technologies, standards, delivery mechanisms, and financial and human resources that facilitate the availability of and access to spatial data (GSDI, 2004; Masser, 2005). It provides a basis for spatial data discovery, evaluation, and application for users and providers, thus increasing the ability to make sound decisions collectively at the various levels. SDI at global, regional and national levels are being advocated to fulfil the gaps in data, data standards and data sharing mechanisms so that resources can be saved from duplications and societies can benefit from easy access to data.

### **1.3 SDI Initiatives in the HKH Region**

At the global level, Global Spatial Data Infrastructure (GSDI) is envisaged to support trans-national or global access to geographic information and it is seen as central to the response to the challenge of global sustainable development (GSDI, 2004). There have been many initiatives by national, regional, and international programs and projects to improve access to available spatial data and promote its reuse even if they are not labelled as "SDI initiatives". There have been formal National SDI (NSDI) initiatives since the beginning of this decade in the HKH countries like India, Nepal, Bhutan and Afghanistan which focused primarily in development of digital spatial data, and formulation of policies and specifications for their distribution. They have been successful in generating awareness on need of a SDI framework. There has been considerable growth in number of users and access to the technology in the region in decade. However, the users are yet to see real differences in terms of availability and accessibility of geographic information. The information available is still fragmented, heterogeneous and not easily accessible to the people who need them. The real applications of the technology are hindered due to lack of proper data sharing mechanisms. The countries in the region are at different stages of development in terms of information technology and data sharing is still a sensitive and complicated issue due to the policies of the individual countries.

## **2. APPROACHES FOR A REGIONAL SDI**

The impacts of climate change on ecosystems and society are expected to intensify in coming decades. Expected impacts include changes in snow cover and glaciers, biodiversity and incidents of extreme events such as glacial lake outburst floods, flash floods, landslides, and avalanches. The climate related changes in mountain ecosystems affecting the provision of environmental services and natural resources will have significant impacts on livelihoods of the communities. The fourth assessment report of Intergovernmental Panel on Climate Change (IPCC) claims progress in understanding how climate is changing in space and in time through improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties, and a wider variety of measurements since its last assessment (IPCC, 2007). However, data coverage remains limited in some regions and the HKH is one region where there is a major gap in observation stations and data coverage. There is a need for improved decision analysis and adaptation strategies which increases demand for policy relevant information. The analyses at global or continental scale are not able to capture spatial patterns of the highly variable mountain environments. Climate change being a cross cutting phenomenon which is not limited by the national boundaries, it will be highly relevant to develop a SDI framework focusing on the requirements at a regional scale to address the issues of data gaps, data resolution and the analyses required for coming up with more realistic adaptation strategies for the HKH region.

Keeping in view these requirements, the Regional SDI will be developed with the activities targeted to the major areas discussed below.

### **2.1 Regional Databases for Multiple Uses**

Unavailability of basic data layers has been a major concern and the data larger than one million scale are restricted in most of the countries in the HKH region. Whereas most of the application areas such as climate change, biodiversity, ecosystem dynamics are of transboundary nature, availability and access to homogeneous data across the borders is a major issue. There have been a number of initiatives at the global level for generating core geographic datasets. However, these global datasets lack the required details to define the mountain geography and ecosystems of the HKH while the national datasets are fragmented and do not provide a complete picture. Therefore there is a strong need to develop regional datasets that are useful for multiple applications.

One of the important activities under the RSDI will be to generate regional datasets at suitable scales which will be usable by different application areas and will promote interdisciplinary and cross-sectoral partnerships. The development of uniform data layers at regional scales such as land cover, infrastructure and socio-economic indicators will be initiated in partnership with relevant national institutions in the HKH countries.

### **2.2 International Standards for Consistent Databases and Sharing Mechanisms**

Another problem with the geographic information is the heterogeneity and inconsistency in the existing databases in different areas and across the boundaries. The projects or the institutions involved in generating geographic information are

focused on their own area of interest and in most of the cases it is difficult to utilize the available databases in a meaningful way. Therefore adoption of international standards while developing regional data layers will be given utmost priority to ensure harmony and compatibility. For example, the land cover data is being developed using the LCCS classification system developed by FAO/UNEP to overcome the problems faced in incompatible legends used in different studies and different countries. The harmonization process will help in facilitating exchange of data within and across the countries as well as make it useful for regional applications.

### 2.3 Network of Metadata Nodes

Discovery of spatial data is an initial step for SDI and metadata is one of the basic building blocks of any SDI initiative (Masser, 2005; Craig, 2005). With the restrictive policies on geographic data sharing in many countries in the region, opening up to share at least metadata will be an important milestone in realizing the RSDI. ICIMOD is promoting adoption of ISO standards for metadata development and it is partnering with Geo-Network initiative of FAO to use its open-source platform for metadata sharing. This architecture is multi-participant, collaborative, and allows organizations to openly share and directly use Geographic Information from many distributed sources at the same time. Collaborations have been initiated with the institutions in Bangladesh and China to establish metadata nodes using Geo-Network and plans are underway for the nodes in Pakistan and Nepal. ICIMOD has adopted these metadata standards and data sharing protocols in its different projects such as “HKKH Partnership for Ecosystem Management” and “Regional Wetland” projects for implementing knowledgebase systems. Promotion of such metadata systems will help in creating a network of institutions which will facilitate in data identification and sharing among the users.

### 2.4 Data Access and Delivery

The core regional geographic data sets will be made available for use in different applications under the strategic thrust areas. The prevailing internet technologies will be utilized for serving the data online so that users can have easy access to uniform datasets. This will greatly facilitate harmonization of geographic information and its use across the region. The Mountain GeoPortal (<http://menris.icimod.org>) developed by ICIMOD to share GIS resources such as metadata, spatial data, application methodologies, publications and training materials will be further extended for online data access and delivery. Initiatives will be undertaken to develop thematic portals focusing on specific needs of different thematic areas such as biodiversity, water and environment (Bajracharya and Pandey, 2004; Bajracharya and Shrestha, 2002). Web mapping applications will be developed using standard (OGC compliant) tools to display locations and geographic backdrops as well as more sophisticated interactive and customizable mapping tools. This will allow quick and easy dissemination of spatial information for a wider audience and help to support decision making.

### 2.5 Outreach and Capacity Building

Institutional, organizational and human resources are seen as the ‘weakest link’ and capacity building for technically skilled human resources is fundamental for maximizing the benefits of SDI in developing countries (Georgidou and Groot, 2002).

Besides setting up metadata nodes and building IT infrastructure, continued efforts are needed to train human resources and institutionalize the process of populating the metadata. Capacity building on GIS and related technologies has been one of the major focus areas and strengths of ICIMOD which has received high recognition in the region. Partnerships and networking among the national and regional institutions and their capacity building will continue to be an important strategy for the development of the RSDI. There will be a continued need of new human resources as well as upgrading of the existing skills in the ever emerging technologies related to management and applications of geographic information. Initiatives will be taken to mainstream geographic information science in the university courses in the region. This will help in promoting applications as well as research in the field which are more focused to the needs of the mountain regions in general and HKH region in particular.



Figure 2. Mountain GeoPortal

### 2.6 Institutional Networking

ICIMOD has been working on promoting regional cooperation through interdisciplinary and cross-sectoral partnerships. Partnerships and networking among the national and regional institutions and their capacity building have been the major strategies for the development of RSDI. The partnership initiative was designed to extend the full functional capabilities of national institutions by developing mutually supportive relationships. The long term goal of RSDI is to develop networks linked by intra-regional institutional framework that provides mechanisms for sharing experience, technology transfer and coordination in development and exchange of geographic information of the region. By networking with proactive and leading institutions involved in geo-information applications in the HKH countries, ICIMOD is aiming to break the barriers in sharing of geographic information and use the technology for the benefit of the mountain people of the region.

## 3. CHALLENGES AND WAY FORWARD

The concept of SDI includes technical, institutional, economical and policy components encompassing multi-disciplines and multi-sectoral institutions. The level of GIS use in the different line agencies participating in NSDI are at different stages and having a uniform approach is often difficult. As the NSDI initiatives need involvement of many government and non-governmental institutions, its implementation with visible impacts take long time. HKH countries have initiated NSDI activities in the different forms such as short term projects or

organization of workshops and conferences bringing together the national and international stakeholders. Looking at the examples of two countries, National Geographic Information Infrastructure Programme of Nepal and NSDI for India (NGIIP; NSDI India), we can see that a large number of institutions are involved participating in a number of sub committees formed to work on different components such as data pricing, sharing policies, standards and so on. Although there is a tendency to follow the international practices, these activities are being carried out in the country specific context and are least concerned with transboundary and regional perspectives.

In the context of emerging common issues such as climate change and its impacts in different sectors, the importance of Regional SDI is even more apparent. The present developments in earth observation technologies with the availability of wide range of satellite images have greatly facilitated the development of regional datasets. However, it has inherent challenges in ground truthing and field verification as most of the areas of HKH are inaccessible.

Setting up metadata nodes and online data clearinghouses are important building blocks for RSDI. Although the ICT and internet infrastructure is continuing diffusion in the region, it can be one of the hindrances in RSDI development at the present state.

Apart from the technical infrastructures and institutional coordination, the major challenge is to mainstream the use of Geographic Information and the related technologies in the regular decision making processes. There is a growing use of geographic information in different sectors for assessment of natural resources, management planning and decision support systems. With the increased use, there is greater realization for need of SDI.

Development of RSDI is even more challenging compared to NSDI as this entails working with institutions from different countries which are governed by different legal frameworks. In this context, ICIMOD being a regional and a non political body, provides a good platform for bringing together the institutions from the regional countries and work on the issues on a purely scientific basis. It provides unique opportunities for networking among similar institutions within the region so that there are opportunities to learn from each other as well as replicate successful approaches and technologies.

#### 4. CONCLUSIONS

With the increasing concerns of climate change and its impacts on the mountain environments and communities in the HKH, there is a growing need of spatial data for better assessment and monitoring of environment and for developing adaptation strategies. While the studies at global scale do not adequately represent the intricacies of mountain environments, the country level initiatives on SDI are confined to the national interests. In this context, a regional perspective has been felt all the more important.

Development of regional datasets adopting international standards will be an important step towards RSDI development. Networking among the national institutions and setting up distributed nodes for metadata sharing using common protocols will help in increasing collaboration as well as building up the data sharing culture. In this regard, thematic portals catering to the needs of specific sectors will have additional contributions

towards RSDI by bringing together more professionals and mainstreaming geographic information in different disciplines.

The development of NSDIs are governed by national policies, but a regional platform with network of institutions will foster harmonization in these efforts by encouraging dialogue between professionals working in the region on a common, compatible integrated GIS platform. In such case, the national efforts can be seen as building blocks of the RSDI.

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