

REDD+ Monitoring Using Remote Sensing Data and Techniques

ICIMOD



FOR MOUNTAINS AND PEOPLE

Introduction

Nepal's forests are one of the nation's largest natural resources. It is one of four countries that have been selected by the Forest Carbon Partnership Facility implemented by the World Bank for promoting forest conservation by controlling deforestation and forest degradation. REDD+ requires a functional monitoring, reporting, and verification system that consists of both biophysical parameters and socioeconomic factors. By integrating remote sensing data and field measurements, forest parameters (canopy cover, basal area, above ground biomass etc.) can be estimated fairly and accurately and at a reasonable cost.

SERVIR connects space to villages by generating geospatial information, including Earth observation data from satellites, geographic information systems, and predictive models useful to developing countries. SERVIR is a joint initiative of USAID (United States Agency for International Development) and NASA (National Aeronautics and Space Administration). SERVIR-Himalaya is implemented in partnership with ICIMOD with an aim to bridge the gap between scientific knowledge and decision making through applications of Earth observation information in the Hindu Kush Himalayan region. Driven by the motto 'Connecting Space to Village', SERVIR-Himalaya works as a regional resource centre by developing relevant geospatial applications and creating enabling environments for their use.



- Prepare sub-national to national level geospatial MRV framework using tested examples
- Develop a customized information system to facilitate the REDD+ monitoring process

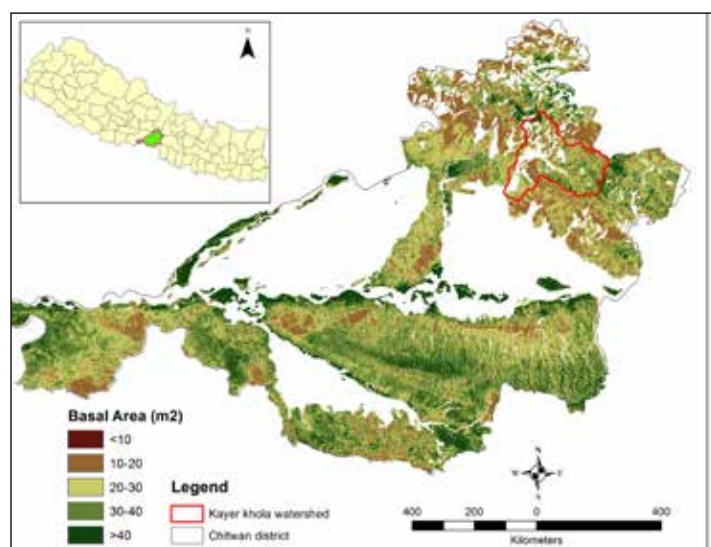
Methods

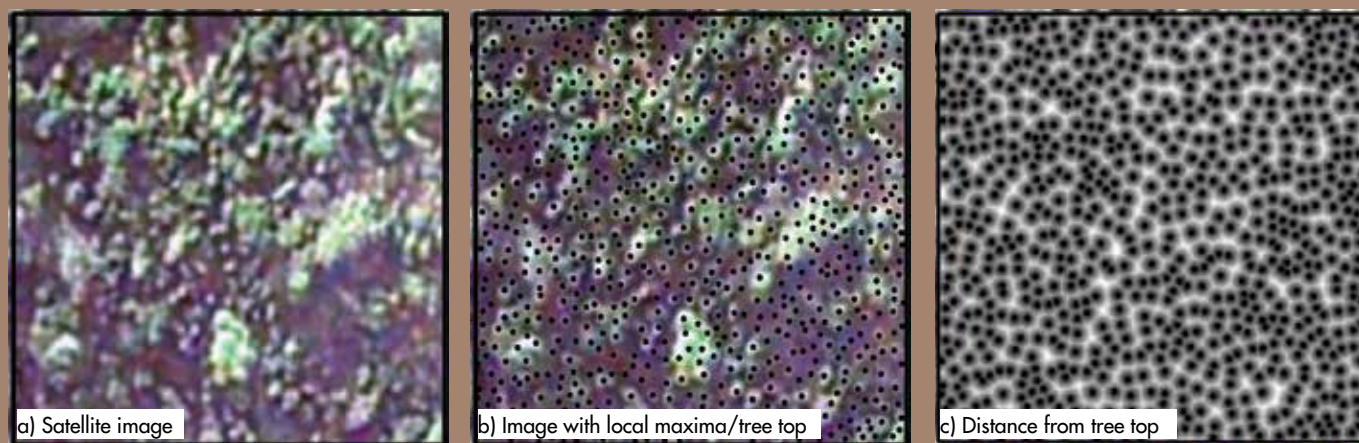
A study was conducted in Chitwan district of Nepal on scaling up the basal area of local scale forest measurements to district level using multi resolution satellite images. The study focused on Khayar Khola

SERVIR-Himalaya and ICIMOD REDD+ Initiative

Estimation of biomass using multi-resolution satellite data and ground information was initiated under a REDD+ pilot project in watersheds located in three districts of Nepal: Chitwan, Gorkha, and Dolakha. The study was further extended and up-scaled under the SERVIR-Himalaya initiative with the following objectives:

- Develop geospatial approaches for scaling up local level forest basal area measurements to the district level using multi-resolution satellite images
- Evolve an error budgeting and validation system at different levels of assessment





watershed to develop the model. The watershed has an area of 80 km², of which 23.81 km² is managed by 16 community forest user groups (CFUGs), while the district has an area of 2,218 km², including Chitwan National Park. The study area was selected on the basis of accessibility, data availability, variation in terrain, and ongoing implementation of a REDD+ pilot project.

Data on crown projected area (CPA) at the watershed level extracted from very high resolution satellite images were related to estimated field-based basal area values. The established relationship helps to estimate values of CPA and basal area on virtually laid down plots on an ArcGIS Online Base Map for the entire district.

The multivariate adaptive regression splines (MARS) modeling technique was applied to calculate basal area across the district using various matrix values such as spectral reflectance, vegetation indices, and topographic profile extracted from landsat TM seasonal data.

REDD+ Online System

A web mapping application allows users to view biophysical and social data of the Khayar Khola Watershed (<http://apps.geoportal.icimod.org/redd/>). The application helps in monitoring deforestation, forest degradation, and biomass changes over a certain time period.

Way Forward

The study has been carried out in close collaboration with the Ministry of Forest and Soil Conservation and other stakeholders in Nepal. ICIMOD, under the framework of SERVIR-Himalaya, is further developing models and high resolution and 30 m resolution biomass maps throughout Nepal.



For further information, please contact:

Hammad Gilani hammad.gilani@icimod.org

Photos: Govinda Joshi

© ICIMOD 2015

International Centre for Integrated Mountain Development

GPO Box 3226, Kathmandu, Khumaltar, Lalitpur, Nepal

Tel +977 1 5003222 **Email** info@icimod.org **Web** www.icimod.org/
www.geoportal.icimod.org

ICIMOD gratefully acknowledges the support of its core donors: the Governments of Afghanistan, Australia, Austria, Bangladesh, Bhutan, China, India, Myanmar, Nepal, Norway, Pakistan, Switzerland, and the United Kingdom.