ANNEX 6: BCC State of the Remote Sensing and GIS Decision Support System

Introduction

UNEP's Division of Early Warning and Assessment (DEWA) has been established to promote availability of, and enhancing access to scientific information needed by decision makers for better environmental management. In Asia and the Pacific Region, DEWA operates through the facility of UNEP Regional Resource Centre for Asia and the Pacific (UNEP RRC.AP), situated in the Asian Institute of Technology (AIT), Bangkok, Thailand, which was established in 1989 as a GRID facility. Activities have been carried out under the direct supervision of the DEWA, in close coordination with UNEP's Regional Office for Asia and the Pacific (ROAP).

UNEP RRC.AP joined the ADB Biodiversity Conservation Corridors Initiative (BCI) as core partner, with major responsibilities in providing technical support to BCI. This includes the development of an environmental and socio-economic database as the basis of BCI's Geographic Information System (GIS) and providing Remote Sensing expertise and GIS-based data analysis.

The BCI Database – Brief Summary

Environmental Data

UNEP RRC.AP currently holds a comprehensive dataset of both Landsat TM and ETM+ ***satellite images***. 52 Landsat scenes align or intersect with the nine BCI focal areas. The geospatial resolution ranges from 30m (TM) down to 15m (ETM+, pan-sharpened), while the temporal coverage stretches over the periods of 1990-1992 (TM) and 1999-2001 (ETM+), respectively.

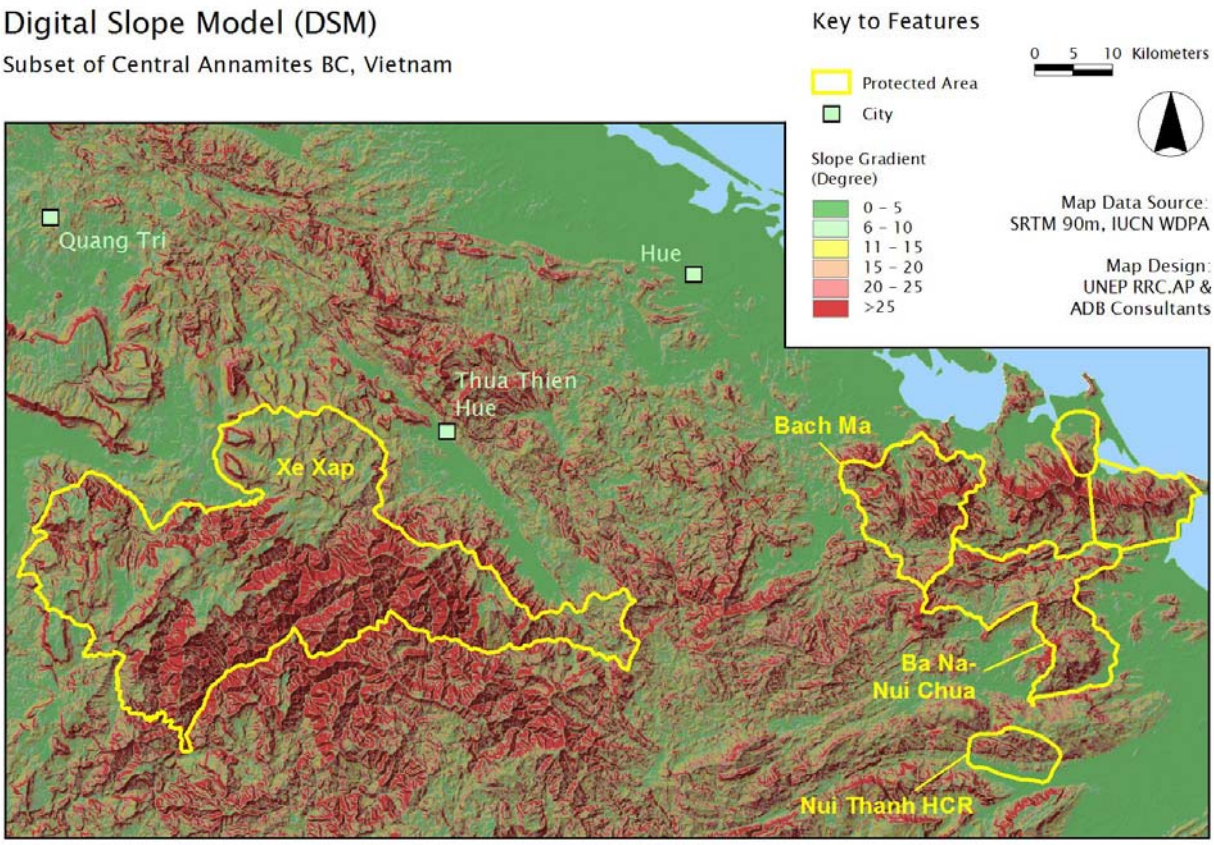
Both Landsat TM and ETM+ are suitable sources for BCI's demand on medium to high resolution land cover classification (LCC). Change detection analysis can further provide BCI with data on land cover / land use change, which are essential for further studies on land degradation, human impact and environmental sustainability.

Though geospatial resolutions of 30m and 15m can be considered sufficient for LCC, BCI might require higher resolution imagery for detailed studies on selected sites. As the Landsat ETM+ sensor has a malfunction since 31 May 2003[1], SPOT images would currently offer the best compromise of geospatial resolution and image cover. As costs of SPOT imagery are exorbitant in comparison to Landsat ETM+, it makes sense to first search for

[1] Failure of sensor's scan line corrector.

existing SPOT products available with BCI partners. Further cooperation with BCI partners is suggested in order to harmonize the Landsat TM and ETM+ database in terms of seasonal consistence, radiometric compatibility and reduction of gaps caused by atmospheric errors (clouds, haze). The Asian International Rivers Centre (Yunnan University, Kunming, China PR), UXO Lao as well as JICA (for Cambodia) have been identified as potential sources for satellite imagery on a first fact-finding mission in January 2005, but additional sources could be identified in subsequent field trips. In addition, there are internet sources (e.g. Global Land Cover Facility, University of Maryland) that can be utilized.

The current ***topographic database*** at UNEP RRC.AP comprises of three resources: 1) a 1km GTOPO30 GRID[2] (GIS-ready) for the entire Asia and the Pacific, 2) 90m SRTM[3] GRID (void filled, GIS-ready) for the entire Greater Mekong Subregion (GMS) and 3) 50m Toposheet-based GRID for the Lower Mekong Watershed (Lao PDR, Cambodia, parts of Vietnam)[4].



While the GTOPO30 dataset with its 1km resolution is not sufficient to be used on a provincial or even district scale, both SRTM (90m) and Toposheet-Data (50m) fulfill BCI's requirements on geospatial resolution. These data enable BCI to draw conclusions not only

[2] Geographic Raster Information Database; GIS data format.
[3] Shuttle Radar Topographic Mission.
[4] Digitized and processed by the Mekong River Commission.

on elevation, but on further terrain information such as slope gradient, aspect and hillshading. Topographic datasets of higher resolution are not required at this period in time.

Land Cover Data currently available for BCI project use five datasets: 1) UNEP RRC.AP Land Cover Classification (LCC) based on NOAA AVHRR[5], 1986 and 1993, 2) FAO Global Forest Resource Assessment, 2000, 3) EC-JRC[6] Land Cover Classification for South and Southeast Asia (LCCSSA), 2000, 4) UNEP RRC.AP Land Cover Classification for SEF[7] Hotspots in the GMS, 1999-2001 and 5) MRC[8] Land Cover Classification for the Lower Mekong Watershed, 1997.

Though the Land Cover Database is comprehensive for work on a subregional scale, the 1km resolution of the UNEP RRC.AP LCC, FAO FRA and EC-JRC LCCSSA fail to provide reliable information on a national level, particularly at the scales required to work at provincial and district levels. The MRC LCC of the Lower Mekong Watershed is of suitable resolution (30m) for work on a national scale. However, as it dates back to 1997 it may not provide up-to-date information for the focal areas. UNEP RRC.AP has worked on a LCC for selected hotspots in the GMS (at 30m resolution, 1999-2001), but results need to be refined by sampling ground control points before further use.

As Land Cover / Land Use is one of the key pieces of information, BCI will develop this database further to comply with the data standards needed to work down to district scale. This will include both Land Cover Classification of recent Satellite Imagery and exchange of land cover information with project partners. A first fact-finding mission in January 2005 has liaised with potential partners in Cambodia (JICA[9], IRIC[10] via SEF domestic consultant), Lao PDR (Ministry of Forestry, UXO Lao, MRC) and Yunnan Province (Asian International Rivers Centre, Yunnan Forestry Bureau, Yunnan Agricultural Bureau) with access to information. The support of the Governments is sought to make these data available for BCI during the next field visits.

As background information about ***protected areas***, BCI currently uses the IUCN World Database on Protected Areas (WDPA).

Additionally, UNEP RRC.AP continues to explore national databases on protected areas in order to check the accuracy of the WDPA and to update the database, if necessary. Both governmental (e.g. Ministry of Environment) and non-governmental partners (e.g. WWF country offices) were contacted as part of the initial fact finding mission in January 2005. While WWF Lao has provided relevant datasets already, other WWF country offices and governmental organizations are encouraged to do so as soon as possible.

Information regarding ***biodiversity*** comes in the form of ranges (habitats) of the region's noteworthy flora and fauna. Stacking this information with land cover information and the range of protected areas will provide the input for a “gap analysis” – the outlining of areas

[5] NOAA Advanced Very High Resolution Radiometer.
[6] European Commission – Joint Research Centre.
[7] Strategic Environment Framework.
[8] Mekong River Commission.
[9] Japan International Cooperation Agency.
[10] Integrated Remote Sensing Information Center.

with high biodiversity value (includes migration paths) but low degree of protection. The input from this analysis will help identifying suitable transition corridors between protected areas.

Initial datasets have been collected for Tiger, Asian Elephant, Gaur, Banteng populations[11]. However, currently available datasets do not contain habitat polygons, but rather local recordings. Future focus is to enlarge the database both with more species as well as their confirmed habitats.

Data comprising the ***River and Water Body Network*** for the GMS are side products of land cover classifications or infrastructural surveys. As such, BCI holds current data on river network, major water bodies and watersheds of the entire GMS.

Though the resolution of the dataset can be considered sufficient for the current requirements of BCI, the river network information needs to be complemented with the names of most of the smaller tributaries.

Boundary/Administrative and Socio-Economic Data

UNEP RRC.AP currently holds a complete ***boundary/administrative dataset*** for national borders, provinces and districts as well as cities and villages.

Most population and economy-related data are collected in tabular format referring to administrative units (provinces, districts). In order to analyze this information in conjunction with other spatial data of the BCI database, up-to-date boundary information is needed to put tabular data into the geospatial context.

BCI still lacks detailed commune level boundary data and village information for all GMS countries except Lao PDR and Cambodia (updated during country-missions in January 2005). However, these data are collected and frequently updated by governmental ministries, whose support BCI seeks in this matter.

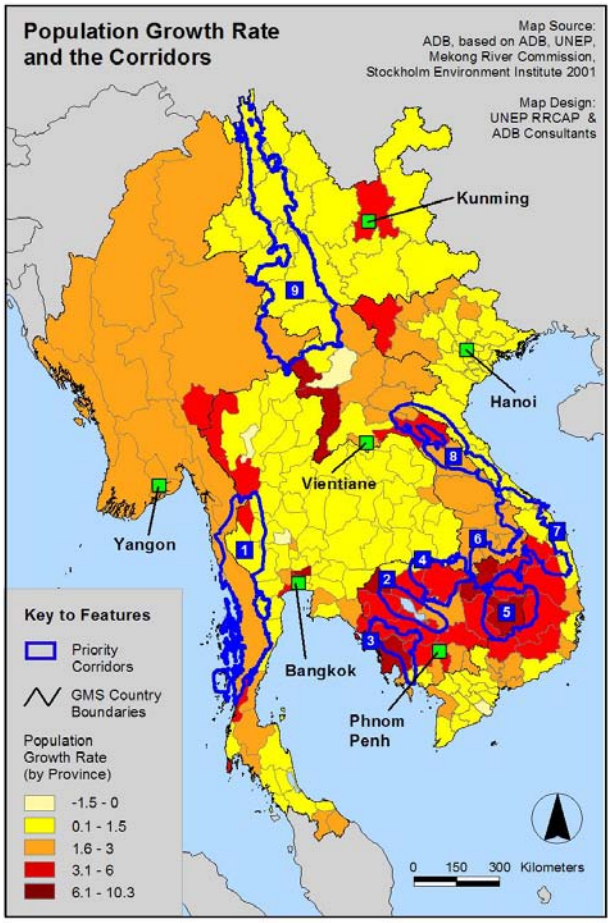
Infrastructural data available to BCI include transboundary and national roads, waterways (river data), railroad network and airports.

As infrastructure supports the accessibility – and use – of natural resources by society, its network is crucial to estimate zones and degree of impact on the future biodiversity corridors.

Due to the rapid growth of the regions economy, infrastructural data needs to be updated on a short term basis. Thus, BCI seeks national datasets that have been localized particularly in governmental ministries. As these data are usually handled confidentially, governmental support is sought in order to update BCI's infrastructural database regularly.

[11] Duckworth, J.W. and Hedges, S.: Tracking Tigers: A Review of the Status of Tiger, Asian Elephant, Gaur and Banteng in Vietnam, Lao, Cambodia and Yunnan (China), with Recommendations for Future Conservation Action. WWF Indochina Programme, Hanoi, 1998.

GIS-ready ***Population-Related Data*** are available on a province level for the entire GMS. This includes population density, population growth and poverty. District level poverty information has been imported to the respective geospatial boundary map from sources such as IFPRI[12] (Vietnam), WFP[13] (Cambodia) and NGPES[14] (Lao PDR).



Population-related data will be essential to estimate human pressure on the ecosystem (population distribution, density, growth; income, poverty) as well as to further specify the kind of pressure applied and kinds of livelihood prevailing.

Problems with the datasets are confined to differences in district naming schemes between the source tables and the boundary dataset and to nationally or even institutionally different surveying and calculation methods that limit transboundary comparison. Furthermore, there are restrictions to data reliability on the province level and a lack of data on the district level, partly due to the fact that population-related statistics are handled confidentially by governmental institutions. Yet, as population-related data are crucial for the precise decision making of the BCI, the strong support of both governmental and non-governmental partners is required to plug these gaps as soon as possible.

[12] International Food Policy Research Institute.
[13] World Food Programme.
[14] Lao PDR – National Growth and Poverty Eradication Strategy.

Summary and Outlook

Under the Biodiversity Conservation Corridors initiative ADB and UNEP RRC.AP have built up a database on environmental and socio-economic information. Currently, the data is sufficient for analyses on a national and provincial level, with parts of the data already suitable for studies on a district (poverty, UNEP 30m LCC) or even commune level (SRTM90 DEM).

With the BCC initiative further developing, the entire database needs to provide district and commune level data in order to successfully comply with the different scales of the study. UNEP RRC.AP has initially collected data and liaised on this issue with governmental and non-governmental organizations during a fact-finding mission to Hanoi (Vietnam), Kunming (Yunnan/China PR), Siam Reap (Cambodia) and Vientiane (Lao PDR) in January 2005. In the near future, BCI plans to further develop these contacts towards active partnerships both in terms of provision of data and exchange of expert knowledge.