



## **Watershed Classification in the Lower Mekong Basin**

Authors: Heinemann, Andreas, Brey, Thomas, and Kohler, Thomas

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## A Survey of Rural Livelihood Strategies in North-West Pakistan

An exploratory survey on rural livelihood strategies was carried out in the North-West Frontier Province of Pakistan within the context of the NCCR North–South. The collecting of data, completed by mid-August 2004, was carried out by a local research team in 3 different villages of the province. As it was one of the survey's aims to gain a better understanding of potential differences between highland and lowland contexts, study sites were selected according to their altitude above sea level and their proximity to regional goods and labor markets.

The survey report focuses on identification of a set of livelihood strategies. Using insights from the field, a typology of strategies was developed. It was based on the geographical range in which rural households operate and generate

their livelihoods. The report also examines the role of various livelihood assets in different strategies.

Initial results show that the diversity of strategies, as well as income diversification among particular strategies, is much higher in the lowlands than in the mountains. Households at high altitudes often have to concentrate on subsistence farming, generating their only cash income through labor migration. Yet households in the lowlands operate mostly in a regional context, thus finding many more alternatives to subsistence farming and migration, such as off-farm labor, regular salaried jobs, or starting an individual business. By March 2005, a short version of the report will be available as an NCCR Working Paper ([www.nccr-north-south.unibe.ch](http://www.nccr-north-south.unibe.ch), publications: see B. Steimann 2005).

A second report, which is based on the same data, focuses on gendered livelihood assets and workloads in the respective villages. It will be complemented by additional, qualitative field research in the spring of 2005. A paper presenting the initial findings of this research is available on the NCCR web site as well ([www.nccr-north-south.unibe.ch](http://www.nccr-north-south.unibe.ch), publications: see K. Siegmann 2005).

For more information, please contact Urs Geiser ([ugeiser@geo.unizh.ch](mailto:ugeiser@geo.unizh.ch)), Bernd Steimann ([bernd@geo.unizh.ch](mailto:bernd@geo.unizh.ch)), or Karin Siegmann ([karin@sdpi.org](mailto:karin@sdpi.org)).

### **Bernd Steimann**

Department of Geography, University of Zurich-Irchel, Winterthurerstrasse 190, 8057 Zurich, Switzerland.  
[bernd@geo.unizh.ch](mailto:bernd@geo.unizh.ch)

## Watershed Classification in the Lower Mekong Basin

### Rapid Economic Growth—A Source of Increasing Potential for Conflict Over Resource Use

#### **The environmental situation in the Lower Mekong Basin**

The Lower Mekong Basin (LMB) arguably has one of the most diverse biotic and cultural landscapes in today's world. However, against the backdrop of residual impacts of the Indochina conflicts coupled with the extraordinary pace of economic development in some of the riparian countries over the last decade, contradictions between economic growth and environmental protection have become increasingly apparent. Fundamental political and economic changes in each country

have had adverse environmental impacts on the region's shared resources. Seeking to replicate East Asian patterns of growth and industrialization, national leaders have pursued economic growth with minimal environmental considerations as a national aim. This has serious environmental consequences for the LMB, such as widespread deforestation, degradation, indiscriminate conversion of agricultural lands, changes in flow regime, pollution of water bodies, declining fish and wildlife populations, and generally decreasing biodiversity—to name only a few.

#### **The Lower Mekong Basin on the Swiss research agenda**

Based on these facts and on the existence of a well-established partner network involving, among others, the Asian Institute of Technology (AIT) and the Mekong River Commission Secretariat (MRCS), the Greater Mekong Subregion was integrated into the global research agenda of the Swiss National Centre of Competence in Research (NCCR) North–South, as one of this comprehensive research program's 9 Joint Areas of Case Studies (JACS)—namely, the JACS South East Asia.

One of the activity lines of the NCCR North–South in South East Asia is concerned with regional syndrome assessment, a task for which the availability of sound and homogenous regional spatial databases is a crucial prerequisite. In this respect, the Watershed Classification Project (WSCP) carried out by the MRCS between 1989 and 2001 has laid a foundation of utmost importance. The WSCP was funded by the Swiss Agency for Development and Cooperation (SDC) and implemented by the riparian states of Cambodia, Laos, Thailand, and Vietnam, in cooperation with the Centre for Development and Environment of the University of Berne.

### **A basinwide watershed classification as a spatial reference base**

The main objective of the WSCP was to elaborate a basinwide classification indicating the sensitivity of watersheds with regard to resource degradation (mainly by soil erosion), which would serve as a support tool for decision-makers at the national and provincial levels. Based on the topography, various parameters crucial to degradation processes, such as slope, elevation and landform, were linked in an empirical watershed class prediction equation. As a result, the project produced over 20 Gigabytes of geographically referenced vector and raster data taken from 1030 topographic maps at a scale of 1:50,000.

A Digital Terrain Model (DTM) with a resolution of 50 meters was then developed for the entire LMB. From these data, the potential degradation risk was derived for each land unit. Finally, risks were grouped into 5 classes, Watershed Class 1 being the most sensitive and Watershed Class 5 the least sensitive to potential soil erosion. These two Watershed Classes can be consid-

ered critical with regard to soil erosion when the land is cleared of natural vegetation; Classes 3 to 5 are regarded as uncritical. Along with the classification, the project produced general recommendations for sustainable land use in each Watershed Class.

#### **1. Watershed Class 1: Protection Forest**

Areas with very steep slopes and rugged landforms, commonly uplands and headwater areas. As a rule, these areas should be under permanent forest cover. However, account needs to be taken of traditional rights and land use practices.

#### **2. Watershed Class 2: Commercial Forest**

Areas with steep slopes, usually at higher elevations, which are in general less susceptible to degradation than Watershed Class 1. Recommended land uses are forestry (conservation and production forests), agroforestry, and grazing, if accompanied by strict conservation measures.

#### **3. Watershed Class 3: Agroforestry**

Areas with moderate to steep slopes and less erosive landforms, including uplands and footzones of slopes. May be used for commercial forestry, grazing, and combinations of trees and agricultural crops, if appropriate conservation measures are applied.

#### **4. Watershed Class 4: Upland Farming**

Gently sloping lands. Wide range of land uses possible. Moderate need for water and soil conservation depending on local conditions.

#### **5. Watershed Class 5: Lowland Farming**

Gently sloping land and flat areas. Suitable, from the point

of view of water and soil conservation, for a wide range of land uses such as paddy rice, other agricultural uses, and forestry.

It is crucial to note that in all classes, land uses other than those recommended above are not excluded, provided that adequate care is given to soil conservation. The recommended land use for areas in Class 1, for instance, is forest cover; nevertheless there are many examples clearly proving that forest cover is not the only solution for conserving steep watersheds.

In order to ensure firm integration of techniques and possible interpretations into the respective national institutions of the riparian countries, the WSCP has successfully provided over 40 formal and on-the-job training sessions to the national WSCP teams.

### **Putting the database to practical use: examples from development, monitoring, and research**

With its database, the WSCP has created an enormous potential for further spatial analysis in combination with other datasets (for example satellite imagery), available and ready to be tapped for development planning, implementation, monitoring, as well as training and education purposes (Figure 1). Up to now, it has been combined with various thematical datasets elaborated by the MRCS and other institutions (eg infrastructure, vegetation) and put to use in regional integrated development and monitoring, dam site planning, telecommunication, and many other spheres, by well over 100 national and international institutions, including bilateral development agencies such as GTZ and DANIDA, and multilateral organizations, such as the World Bank and the Asian Development Bank. The WSCP data constitute

**FIGURE 1** Typical landscape in a head watershed in northern Laos: 3D view with an aerial photograph taken in 1992, superimposed on Digital Terrain Model. (Figure compiled by Andreas Heinimann)



the best homogenous baseline data available for the Lower Mekong Basin to date.

The WSCP regional database was supplemented by a regional watershed directory presenting key watershed parameters, including slope classes, erosion risk, vegetation cover, population, and infrastructure. This directory, which covers over 100 watersheds in Laos, the Thai part of the Mekong Basin, Cambodia, and Vietnam, has become a major reference base for a number of bilateral development projects.

Finally, the NCCR North–South uses the WSCP regional database for research purposes within two research projects—one dealing with patterns of land cover change in the LMB, and the other with poverty modeling in Vietnam. The valuable baseline data enable these projects to efficiently carry out their research objectives by deriving accessibility and population density models. Along with these mainly research-oriented projects, the NCCR North–South has also elaborated an A3 hardcopy *Socioeconomic Atlas of Vietnam* (see book review on

pp 185–187 of this issue of *MRD*), a publication intended to further diminish the gap between data, knowledge, information, and informed decision-making, to support mitigation activities in the region.

**Andreas Heinimann, Thomas Breu, and Thomas Kohler**

Centre for Development and Environment,  
Steigerhübelstrasse 3, 3008 Berne, Switzerland.  
Andreas.Heinimann@cde.unibe.ch  
Thomas.Breu@cde.unibe.ch  
Thomas.Kohler@cde.unibe.ch

## Recent News from the Diversity in Mountain Systems Commission of the International Geographical Union (IGU)

*During the 30th International Geographical Congress in Glasgow, Scotland, UK, the General Assembly of the International Geographical Union (IGU) confirmed the Diversity in Mountain Systems Commission. Members are encouraged to conduct mountain research, inform other members about their work, and participate in the Commission's activities and meetings. The Commission also publishes an e-mail newsletter featuring news on achievements in mountain geography. For further information on this IGU Commission and possible membership, please contact the author of this article. We also suggest contact with the Mountain Forum.*

### 30th International Geographical Congress in Glasgow, Scotland, 15–20 August 2004

The main Congress theme, "One Earth, Many Worlds," offered a framework for an exciting and wonderfully diverse academic program. Particular sections of the program were devoted to sessions organized by the IGU Commissions. The Congress also incorporated the 2004 Annual International Conference of the Royal Geographical Society (with the Institute of British Geographers), a Joint International Geomorphology Conference on "Geomorphology and Sustainability," as well as meetings of the International Cartographic Association, the British Cartographic Society, and the Association of Geographic Information. A choice of academic excursions before, during, and after the Congress offered the opportunity to extend academic discussion. Further variety was added to the Congress through a rich program of one-day academic excursions and a social program, as well as an Inter-

national School Poster Competition involving pupils from over 26 countries.

The Diversity in Mountain Systems Commission organized 6 sessions and a business meeting covering one day of intense exchange of research results, fruitful discussions, and development of visions for the coming years. The program included sessions on biotic and natural landscape diversity, climate and water in mountain environments, sustainable development in mountain areas, political and societal diversity in mountain systems, mountains in the post-Soviet transition process, and regional case studies in Asia.

During the Commission's business meeting, Professor emeritus Bruno Messerli (Geographical Institute, University of Berne, Switzerland) was elected an Honorary Member of the Diversity in Mountain Systems Commission. He joins Professor emeritus Jack Ives (*MRD* Founding Editor) as an Honorary Member of the Commission. Both scholars have played a prominent role in international mountain science, and both have acted as chairpersons of the IGU Mountain Commission for decades, promoting research networks and projects such as the UNESCO Man and the Biosphere Programme. They made significant contributions to the United Nations Conference on Environment and Development in Rio de Janeiro, and in 1997 edited a summary monograph on global mountain issues that became the scientific foundation for the International Year of Mountains 2002. In 2002, Bruno Messerli was awarded the Founder's Medal of the Royal Geographical Society, and in 2003 he was elected a foreign member of the Russian Academy of Sciences.

### Other news and events

Professor Lawrence Hamilton, Senior Adviser of IUCN–The World Conservation Union, was honored by receiving the King Albert I Gold Medal Award. The awards ceremony took place in Pontresina, Switzerland, on 11 September 2004. The IGU Commission congratulates Professor Hamilton!

Professor Fausto Sarmiento, member of the Commission's Steering Committee between 2000 and 2004, reports that he became the Vice Chair for Mountains, Capacity Building, for the World Commission on Protected Areas (WCPA) of IUCN–The World Conservation Union. The Commission's four-year planning includes 3 international conferences on management of mountain protected areas: *Conservation Corridors* (Ecuador 2006), *Transboundary Conservation* (Nepal 2007), and *Ecotourism* (China 2008).

The Global Observation Research Initiative for Alpine Environments (GLORIA) has established new monitoring sites in different mountain regions during the past year: Kosciuszko National Park in Australia's Snowy Mountains, as well as 2 sites in North America and the first German site in the Northern Alps. New target regions will be established in some UNESCO Biosphere Reserves in Chile, Peru, and the Russian Altai Mountains. For more information about this project please visit [http://www.gloria.ac.at/res/gloria\\_home/](http://www.gloria.ac.at/res/gloria_home/)

#### Jörg Stadelbauer

Chairman, Diversity in Mountain Systems Commission, Department of Cultural Geography, University of Freiburg, Werderring 4, 79085 Freiburg, Germany.  
joerg.stadelbauer@geographie.uni-freiburg.de