



## **Hans H. Ruthenberg-Graduierten-Förderpreis 2003/**

## **Hans H. Ruthenberg Award for Graduates 2003**

Nina Nikolic "Vegetation and Soil Assessment along a Land Use Gradient Hillside in the Uplands of Northern Vietnam"

University of Hohenheim, 2002

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### Summary

#### Problem statement

The highest population pressure on agricultural land and the highest incidence of poverty in the country have led to a breakdown of local shifting cultivation land management systems in the mountainous region of Northern Vietnam. As a consequence, the "barren land", degraded, low-productive land, unsuitable for agriculture and forestry, has already extended to one third of the region's area. The livelihood of more than 90% of the inhabitants, however, is heavily dependent on agriculture. Notwithstanding the urge for reclamation, scientific information available about natural recovery potentials and constraints of that ecologically fragile land is still not sufficient.

#### Objectives of the research

The work presented here is an explorative pilot study with the objective of providing preliminary information about vegetation, soil, and related land use histories of one selected hillside in the province of Bac Kan, Cho Don district, Northern Vietnam. The findings of this work are to be used as the basis for the subsequent establishment of a long-term vegetation dynamics study.

#### Methodological approach

The research locality was selected on the basis of existing data on agroecological zoning and distribution and extent of pedomorphological and geological units in the district; it was chosen to represent spontaneous vegetation of a typical series of consecutive land uses after forest clearing. The physiognomic description of the encountered vegetation was based on the principles of the Braun-Blanquet school; the species composition, stratification, and abundance-dominance indices of species were recorded in each delineated vegetation unit. In addition, trees and tree saplings of the forest stands were quantitatively assessed by the point centered quarter method (PCQ). Soil pH, organic matter content, CEC, N, P and K concentrations, Al saturation, clay content, and bulk density were analysed. Three soil profiles were opened, described and sampled. Land use history and local land use strategies were assessed with the aid of Participatory Rural Appraisal (PRA) tools.

## Results

The major findings of this study can be summarized as follows:

- a) On the selected hillside of 1.35 km length, a total of 352 plant species belonging to 245 genera of 80 families were identified within the 13 distinguished physiognomic units. The gradual vegetation transition described represents a sequence of seral stages in a regressive succession of the climax laurel forest (dominated by Lauraceae, Fagaceae and Magnoliaceae) towards degraded pasture dominated by *Paspalum conjugatum*, *Axonopus compressus* and *Chrysopogon aciculatus*. On the basis of the importance values of the tree species obtained by PCQ it was possible to assess the degree of disturbance and the direction of regeneration of the forest communities.
- b) The soil was determined as Dystric Cambisol, with the main constraints of low base and high Al saturation and high skeleton percentage.
- c) The differences in physiognomy and concomitant soil properties arise as a consequence of different land use and disturbance histories. Improved soil characteristics occur with denser vegetative cover of previous fallow and contribute to denser vegetation of a following regrowth cycle. The cyclic repetitions of an apparently regular pattern of disturbance determine the vegetation type, which, over the time span of a fallow length of about 20 years, causes the soil property differences among physiognomic units.
- d) The disturbance by buffaloes is recognised as the major factor affecting vegetation regeneration.
- e) The information on land use histories of the surveyed plots obtained from local land users was essential for explaining the origin of the differences among the physiognomic units.
- f) Mismanagement of the research locality is reflected in forest degradation, overgrazing, soil erosion and weed invasion.

Furthermore, an additional issue of concern arose:

- g) The spread of non-native weeds threatens both agricultural production and regeneration potential of native vegetation.

Finally,

- h) A flowchart reconstructing successional pathways of fallow vegetation of the research locality as a function of disturbance intensity has been proposed.

## Relevance of the results for practical application

Degradation renders land the key factor that limits agricultural production and fuels the vicious cycle of poverty and further environment degradation. Therefore, achievement of sufficient agricultural production that will combat rural poverty and accompanying malnourishment and food insecurity, relies, prior to all other factors, on land conservation and rehabilitation. Successful rehabilitation strategies have to be built upon the understanding of particular vegetation and soil relations in target areas. Ergo, the documentation and analysis of vegetation and soil relations presented in this work offer a foundation information for assessing the type and severity of land degradation, and the basis for subsequent formulation of sustainable land rehabilitation practices.