VEGETATION AND ECOLOGICAL CONDITIONS IN THE FLOODPLAIN OF THE MORAVA RIVER (SLOVAKIA)

Oťahelová, Helena, Viera Banasová, Ivan Jarolímek, Mária Zaliberová, Ján Oťahel, Ján Feranec & Štěpán Husák

Abstract

The Slovak part of the Morava floodplain is a valuable semi-natural ecosystem with a high diversity of plant species and their communities. The changes in vegetation are monitored at several levels and with different techniques such as aerial photography, land cover maps, vegetation maps, surveys of flora and plant communities and measurement of relevant ecological parameters. Surveys of flora and plant communities are made in the whole study area, while maps and ecological measurements are carried out on two selected plots.

Oťahelová, H., V. Banasová, I. Jarolímek, M. Zaliberová, J. Oťahel, J. Feranec & Š. Husák: **Vegetation und ökologische Bedingungen im Überschwemmungsgebiet der March (Slovakei)**

Der slowakische Teil des Überschwemmungsgebietes der March ist ein wertvolles naturnahes Ökosystem mit einer hohen Diversität von Pflanzenarten und -gesellschaften. Monitoring der Vegetationsveränderungen wird auf verschiedenen Ebenen und mit verschiedenen Techniken durchgeführt: Luftbild-Fotografie, Landnutzungskarten, Vegetationskarten, Erhebungen der Flora und Pflanzengesellschaften, Messung relevanter ökologischer Parameter. Erhebungen der Flora und Pflanzengesellschaften werden im Untersuchungsgebiet flächendeckend durchgeführt, Karten und ökologische Messungen beziehen sich auf zwei ausgewählte Probeflächen.

Oťahelová, H., V. Banasová, I. Jarolímek, M. Zaliberová, J. Oťahel, J. Feranec & Š. Husák: **Vegetace a ekologické podmínky v nivě řeky Moravy (Slovensko)**

Slovenská čast inundační oblasti řeky Moravy patři k hodnotným polopřirozeným ekosystémům oplývajícím vysokokou pestrostí rostlinných druhů a jejich spoločenstev. Změny vegetace jsou monitorovány na několika úrovních a s použitím různých metod - leteckých snímků, map pokryvu země, vegetačních map, inventarizace flory a rostlinných společenstev a sledováním vybraných ekologických parametrů. Soupis rostlinných druhů a jejich společenstvech je vypracováván pro celou studovanou oblast, zatímco mapy a měření ekologických parametrů jsou prováděny na dvou vybraných lokalitách.

INTRODUCTION

In recent years great attention has been paid to the investigation of wetlands. The floodplain of the Morava river is a typical example. The vegetation and ecological conditions of the Slovakian part of the floodplain are studied in the framework of the research programme supported by the Grant Agency of the Slovak Academy of Sciences No. 2/999250 and by the East-West-Project No.20. of the Austrian Academy of Sciences, which represents a part of the project "Ecotones River Danube - River March". The study area has been evaluated in 1993 as a wetland of international importance according to the Ramsar Convention.

STUDY AREA

The study area is located in the Záhorská nízina lowland, in south-western Slovakia in the floodplain of the Morava river, between the mouth of the Morava river into the Danube and the mouth of the Myjava river (an eastern tributary of the Morava river). This area represents a fluvial, cc 72 km long corridor, which is bounded by the Morava river bed and the east-side protective dam. The area lies between 135-152 m altitude, and has a low river gradient (0.2 - 0.3 ‰). The numerous depressions remaining after the former oxbows give evidence of the activity and migration of the river in the past. The erosive and accumulative activity of the Morava river was limited by the construction of the protective dams from the 19th to the middle of the 20th century. As a frontier zone with neighbouring Austria, this area was closed to civilian activities for 40 years. Therefore, semi-natural riverine ecosystems have been preserved in this area.

The climate is warm and slightly dry. The highest daily average temperatures are above 20°C in July; the lowest ones fall below -2°C in January; average precipitations are 530 - 650 mm. Phytogeographically, this area belongs to the Eupannonian xerothermic flora.

One of the most important components of the ecosystem is the vegetation cover. Investigations in the Slovakian part of the floodplain of the Morava river started in 1991. The changes of vegetation are monitored at several levels and with different techniques such as aerial photography, land cover maps, vegetation maps, surveys of flora and plant communities and measurment of relevant ecological parameters. Surveys of flora and plant communities are made in the whole study area; maps and ecological measurements are carried out on two selected plots situated south of the village Vysoká pri Morave (river kilometers 11.0 to 15.0) and north-west of the village Malé Leváre (river kilometers 57.0 to 58.8).

DATA AND MAPS

Remote sensing data occupies an important place in modern cartography. As the first step, we made aerial photographs from a helicopter on a KODAK 2443 Ectachrome infrared film. From the colour infrared photographs, positive paper copies were made and arranged into photomosaic maps (scale 1:10 000). The map of land cover was formed with emphasis on the habitat types (OTAHEL & FERANEC 1993).

The relief data were digitalized from a topographic map (scale 1:10 000) in the Gauss-Krüger projection and for their presentation and integration we have used the geographical information system (GIS) SPANS (FERANEC et al. 1993). The aerial photographs, elevation maps as well as the results of botanical field observations were used for compiling the vegetation maps (OTAHEL et al., in press, Fig.1). Mapping units, compatible with the CORINE project, are characterized by floristic composition and vegetation structure as well as the ecological properties of the habitat and by its management. The vegetation cover

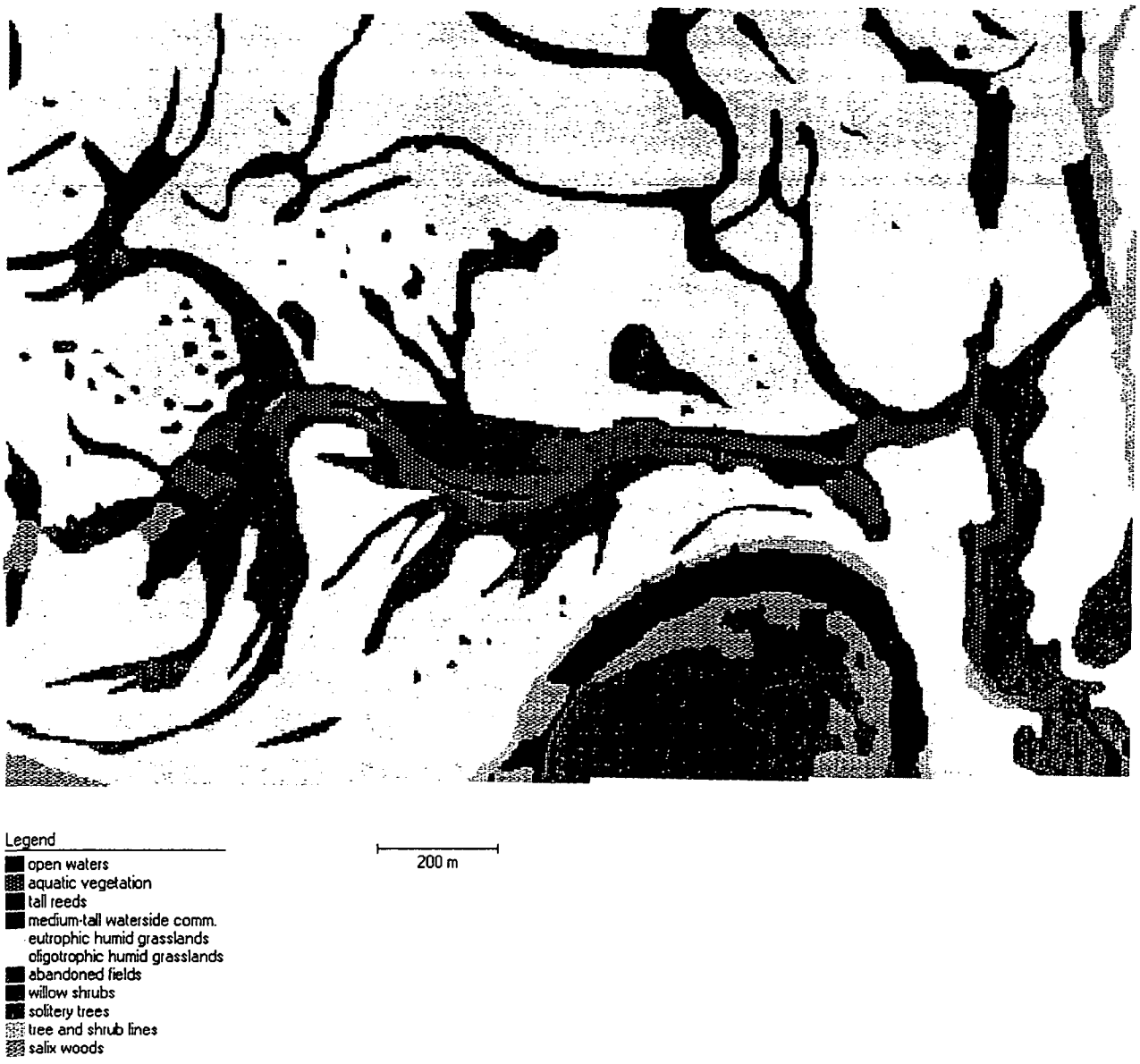

Fig. 1: Vegetation cover

in the first area has been evaluated in the form of fourteen mapping units: Vegetation of river courses, Aquatic vegetation, Tall reeds, medium-tall waterside communities, eutrophic humid grass-lands, oligotrophic humid grasslands, abandoned fields, field crops, willow brush, *Salix rubens* dominated woods, *Populus nigra* dominated woods, *Fraxinus angustifolia* dominated woods, solitary trees, tree and shrub lines. Maps of the actual vegetation represent an important information base for the long-term monitoring of changes of the spatial vegetation structures.

SURVEYS OF FLORA AND PLANTS COMMUNITIES

The floodplain of the Morava river is a valuable semi-natural ecosystem with a high diversity of plant species and their communities. In accordance with the CORINE-project we have distinguished the following biotopes in this area: running waters, standing fresh waters, marshes, humid grasslands, sand dunes, alluvial forests and artificial landscape (OTAHELOVÁ et al., in press). A systematic investigation of the flora and vegetation has been running in recent years, with the aim to complete the basic knowledge of the structure and dynamics of vegetation cover. The continuous floristic and phyto-

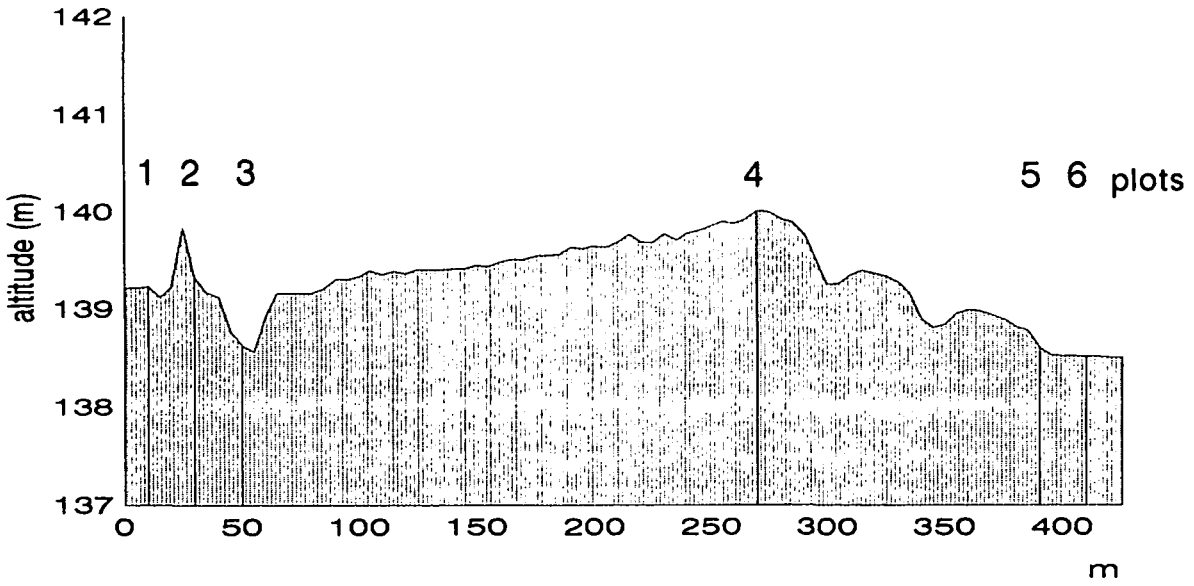

Fig. 2: Distribution of dominated plant communities on 6 plots along the transect. 1 - Populus nigra com., 2 - Cnidium dubium-Alopecurus pratensis com., 3 - Carex gracilis com., 4 - Festuca nigrescens com., 5 - Glyceria maxima-Carex gracilis com., 6 - Schoenoplectus lacustris com.

coenological inventory takes place in the whole floodplain with an emphasis on endangered species. Up to now we have a list of 540 species, 88 of them belong in Slovakia to the endangered taxa. The data obtained are published gradually (OTAHELOVÁ & HUSÁK 1992, OTAHELOVÁ et al. 1992, OTAHELOVÁ & ZLINSKÁ 1993, ZLINSKÁ & OTAHELOVÁ 1992, ZALIBEROVÁ et al. 1993).

Phytocoenological relevés as well as their assessment are made according to the methods used by the Zürich - Montpellier School. The survey of plant communities includes 37 units of the classes Lemnetea, Potametea, Phragmiti - Magnocaricetea, Molinio - Arrhenatheretea, Alnetea glutinosae, Salicetea purpureae and Quercо-Fagetea. More detailed characteristics of the water and marsh vegetation are given by OTAHELOVÁ et al. (in press). The forest vegetation is characterized by JAROLÍMEK (in press), while the brush vegetation by ZALIBEROVÁ (in press) and sand vegetation by STANOVÁ &ŠEFFER (in press).

MEASURMENT OF RELEVANT ECOLOGICAL PARAMETERS

Structural and functional characteristics of wetland ecosystems are influenced by many ecological factors. Among them, the hydrological regime plays the primary function. Since January 1992, the water level has been measured in two-week intervals on 17 plots arranged in two line transects in the vegetation within the floodplain. The transects were chosen to reflect representatively the highest relief diversity and the corresponding types of vegetation (Fig. 2.) The relationship between vegetation structure and selected environmental factors like flood duration, changes of ground water level (Fig. 3.), soil texture (Fig. 4), content of anions and cations in soils (Fig. 5.) is the subject of ecological research (c.f. BANÁSOVÁ et al., in press).

It seems necessary to continue observations and measurements for more years to.

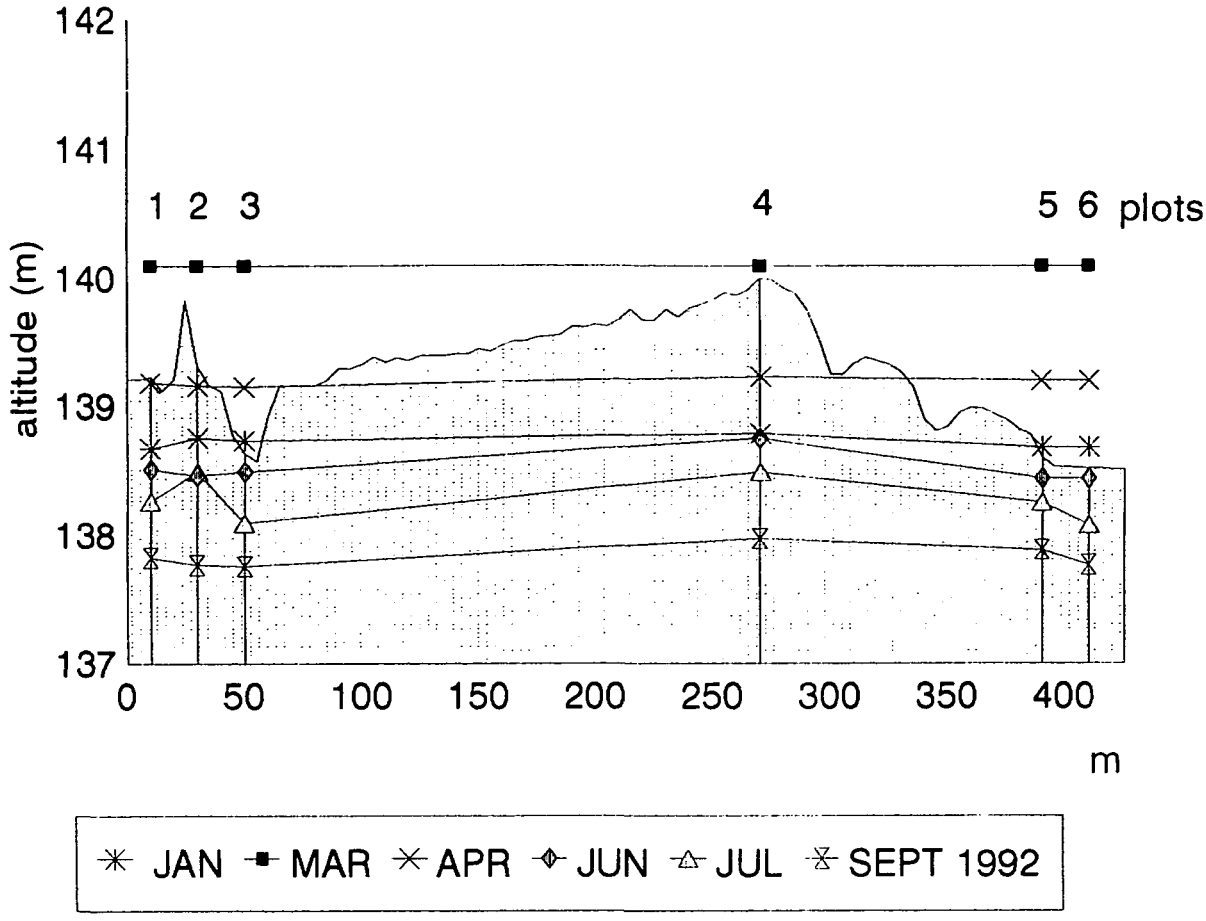

Fig. 3: Course of water level

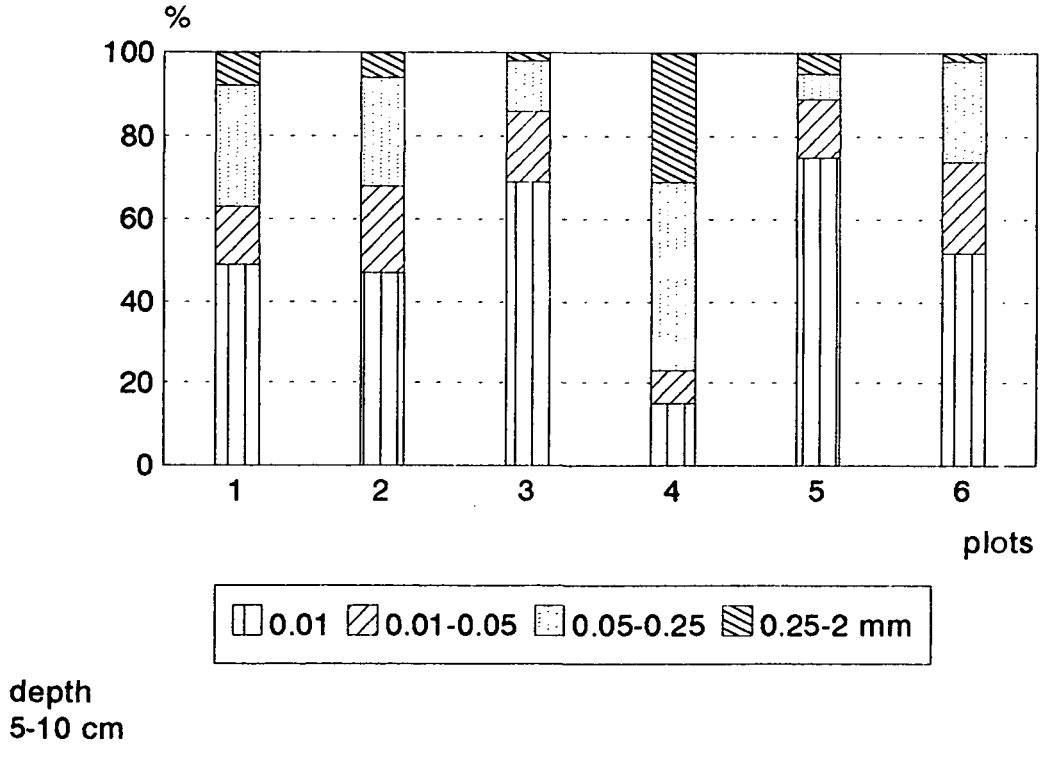

Fig. 4: Soil texture

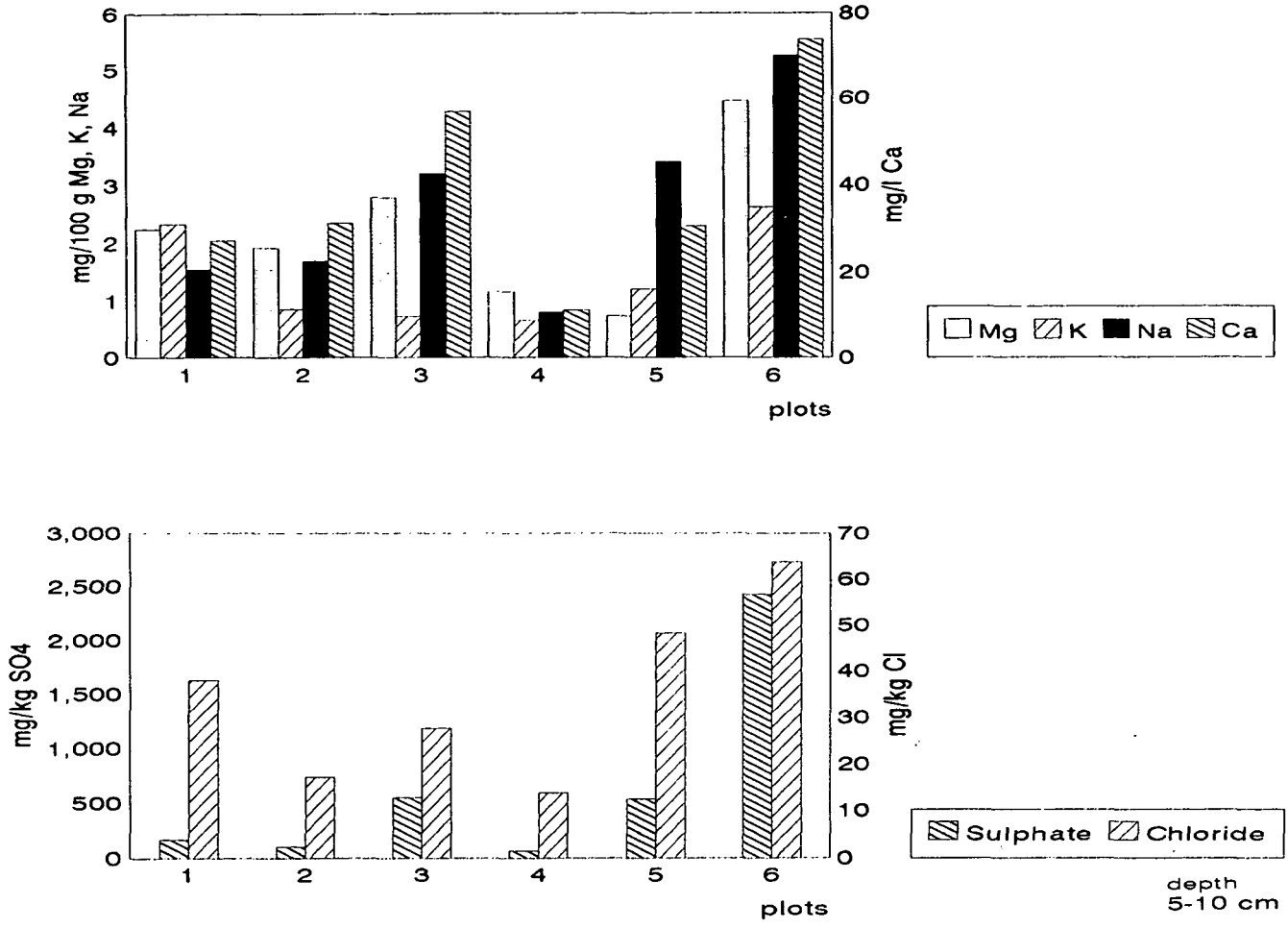

Fig. 5: Contents of cations and anions in the soils

obtain reliable characteristics of the temporal variability of hydrological regime.

REFERENCES

BANÁSOVÁ, V., H. OTAHELOVÁ, I. JAROLÍMEK, M. ZALIBEROVÁ & Š. HUSÁK (in press): Morava river floodplain vegetation in relation to limiting ecological factors. Ecology, Bratislava.

BANÁSOVÁ, V., H. OTAHELOVÁ, I. JAROLÍMEK, M. ZALIBEROVÁ, G.A. JANAUER & Š. HUSÁK (in press): The influence of important environmental factors on the vegetation structure in the alluvial plain of the River Morava. Ecology, Bratislava.

FERANEC, J., J. OTAHEL & M. ŠÚRI (1993): Vegetation mapping by airborne infrared colour photographs and GIS SPANS. Geodetický a kartografický obzor, Praha, **38**/81: 170-175.

JAROLÍMEK, I. (in print): Contribution to knowledge of forest communities along Morava river. Ecology, Bratislava.

OTAHEL, J. & J. FERANEC (1993): Land Cover (Habitat Types) Map Based on the Colour Infrared Aerial Photographs as a Tool for Vegetation Analysis. Proceedings of the Ninth Thematic Conference on Geologic Remote Sensing. Passadena, 535-544.

OTAHEL, J., J. FERANEC, M. ŠÚRI, G.A. JANAUER, H. OTAHELOVÁ & V. BANÁSOVÁ (in press): Vegetation formations map compiled by application of the colour infrared aerial photographs and GIS SPANS as a tool for flood plain vegetation analysis. Proceedings of International Symposium "Satellite imagery

for mapping and Geographic Information Systems". Tunis, 6-9 Dec. 1993.

OTAHELOVÁ, H., V. BANÁSOVÁ, I. JAROLÍMEK, Š. HUSÁK, M. ZALIBEROVÁ & J. ZLINSKÁ (1992): On the occurrence of endangered taxa of Slovak flora on the floodplain of lower flow of Morava river (in Slovak). Bull. Slov. bot. spol., Bratislava, **14**: 34-35.

OTAHELOVÁ, H., V. BANÁSOVÁ, I. JAROLÍMEK, H. RUZIČKOVÁ, V. STANOVÁ & M. ZALIBEROVÁ (in press): The vegetation in the inundation area of Morava River from the viewpoint of biodiversity and endangerment (in Slovak). Proceedings of workshop "Ochrana biodiverzity na Slovensku", Záhorská Bystrica, Slovensko, 6.- 8. IV. 1993.

OTAHELOVÁ, H. & Š. HUSÁK (1992): A contribution to knowledge of the flora of Morava River (in Slovak). Bull. Slov. bot. spol., Bratislava, **14**: 36-42.

OTAHELOVÁ, H., G.A. JANAUER & Š. HUSÁK (in press): Beitrag zur Wasser- und Sumpfvegetation im Marchinundationsgebiet (Slovakei). Ecology, Bratislava.

OTAHELOVÁ, H. & J. ZLINSKÁ (1993): *Lindernia procumbens* (KROCK.) Philcox im Marchüberschwemmungsgebiet in der Slowakei. Biológia, Bratislava **48**/1: 61-65.

STANOVÁ, V. & J. ŠEFFER (in press): Acidophilous sand vegetation of dune system on locality Borová - description and indirect gradient analysis. Ecology, Bratislava.

ZALIBEROVÁ, M. (in press): Die Strauchweidengesellschaften im March Alluvium. Ecology, Bratislava.

ZALIBEROVÁ, M., H. OTAHELOVÁ & V. BANÁSOVÁ (1993): The interesting locality of psamophytes in Morava river-alluvium (in Slovak). Bull. Slov. bot. spol., Bratislava, **15**: 61-63.

ZLINSKÁ, J. & H. OTAHELOVÁ (1992): *Cardamine parviflora* L. im Inundationsgebiet des Flusses Morava. Biológia, Bratislava, **47**/7: 593 - 595.

Addresses of the authors:

Oťahelová, Helena, Viera Banasová, Ivan Jarolímek, Mária Zaliberová
Institute of Botany
Slovak Acad. Sci. Bratislava
SLOVAK REPUBLIC

Oťahel, Ján & Ján Feranec
Institute of Geography
Slovak Acad. Sci. Bratislava
SLOVAK REPUBLIC

Štěpán Husák
Institute of Botany
Czech Acad. Sci.
Třeboň
CZECH REPUBLIC